S/N 100089

# DIGITAL VOLTMETER
# ACCESSORY MODULES
# MODELS 020, 030 & 031

DANA™

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# INSTRUCTION MANUAL
# 980243

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# SECTION 1

# GENERAL DESCRIPTION

## 1.1 INTRODUCTION

This manual describes Model 020, 030, and 031 Accessory Modules used with Dana Model 5400 or 5403 Digital Voltmeter. All three Accessory Modules allow measurement of DC Volts, DC/DC Ratios, Millivolts, and AC Volts. Modules 030 and 031 provide the additional capability of Kilohm measurement. Module 031 differs only in the number of AC ranges; it has four while the 020 and 030 Modules have three. Since the instruments are similar except for the above differences, descriptions in this manual refer to all three modules unless otherwise indicated.

The Accessory Module (the right-hand drawer of the instrument) is a signal conditioning unit for the Digitizing and Display Module (the left-hand drawer). Its function is to convert the various types of inputs into ten-volt full scale voltages for measurement by the digitizing circuitry. The Digitizing and Display Module, Model 5400 or 5403, is covered in a separate manual: "5400 Series Digital Voltmeters".

Figure 1.1. Model 5403 Digital Voltmeter with Model 030 Accessory Module

All functions and ranges are selected by switches on the front panel of the Accessory Module. The output is displayed on a four-digit visual readout with accuracy preserved at the range cross-over points by a fifth "overrange" digit that extends each range by 10% (9999 to 10999). An Electrical Output/Programming Accessory is available to provide a binary-coded decimal (BCD) output for driving a printer or other digital recording device — and to allow the range selection, function selection, and read commands to be made externally. This Accessory is described in the "Electrical Output/Programming Accessories" manual.

Two additional standard features of the instrument are the Automatic Ranging function and the Analog Output. With automatic ranging (Auto Range), circuits within the instrument determine the optimum range for the function being measured and switch to that range automatically. An analog output voltage, proportional to the signal being measured, is available at terminals on the front panel of the instrument. This voltage, at ten volts full-scale (plus overrange), allows analog recordings to be made in parallel with digital measurements. Many other applications for the analog output are possible — including its use as a precision voltage source.

All circuits, other than the power supply, are mounted on plug-in printed circuit boards. The power supply is located at the right rear of the instrument and is common to both the accessory module and the digitizing and display module. Next to the power supply is the remote Programming/Electrical Output accessory. Two of the printed circuit boards in the Accessory Module are offered as optional accessories. These are the AC Converter and the Ohms Converter. These boards and the Programming/Electrical Output accessory may be supplied with the instrument or added at any later time. The circuit boards contained in a fully-equipped instrument are listed below:

REAR

| ELECTRICAL OUTPUT AND PROGRAMMING | POWER SUPPLY |
|---|---|
| Digitizing and Display Module | J21 - Ohms Converter (030-031)<br>J20 - Auto Polarity<br>J19 - AC Converter<br>J17 - Range Control<br>J16 - Isolator<br>J15 - Control & Attenuator |

CONTROL PANEL

## 1.2 OPERATIONAL DESCRIPTION

The Digitizing and Display Module of the Dana Digital Voltmeter uses the null balance technique to measure the amplitude of unknown voltages. The Accessory Module converts the input signal to a 10-volt full-scale analog voltage. For example, if the controls are set to measure AC volts on the 100-volt range, a 50-volt rms input signal results in an internal analog voltage of 5 volts DC. This voltage is applied to the Digitizing and Display module where it is "digitized" by comparison with a series of trial-and-error currents, each of which is derived from a known digital fraction of a reference voltage. Precision resistors in the reference-current divider or digital-to-analog converter (DAC) are capable of dividing the reference into 10,000 equally-spaced current increments and to arrive at the closest increment in a maximum of 36 trials. The total digitizing time is less than 2 milliseconds.

When a null balance has been achieved, the digital setting of the DAC is displayed on the DVM visual readout. The number shown is, in effect, the ratio between the input signal and the reference voltage in parts per 10,000.

When absolute measurements are being made, a highly stable Zener-controlled, 10-volt internal reference is used. Since full scale analog voltage from the Accessory Module is also 10 volts (converted to a precision current), the displayed value is read directly in DC volts, millivolts, AC volts, or kilohms, with proper placement of the decimal point ot adjust for any ranging that has been performed.

In the above example, the 50-volt rms AC input signal would produce a 5-volt internal analog voltage, which would be balanced by the 10-volt internal reference when the DAC arrives at a value of 5,000 (parts per 10,000). The digital display would carry the numerals 5-0-0-0, and range information from the Accessory Module would place the decimal point to read 50.00. An indicator symbol on the display would show that AC volts were being measured.

In the ratio measuring mode, the internal 10-volt reference is replaced by a positive external DC voltage, which may vary from +1 to +11 volts. The displayed value is the ratio between a DC input signal and the reference voltage at that instant. The ratio between +DC voltages and the reference are shown as plus (+) ratios; the ratio between -DC voltage and the reference as minus (-) ratios (the external reference voltage must always be positive). This bipolar ratio capability is of particular value in applications, such as bridge balancing, where inputs are likely to pass through zero. Since the signal and reference voltages are being detected simultaneously, the accuracy of the ratio measurement is independent of the stability of the voltage source.

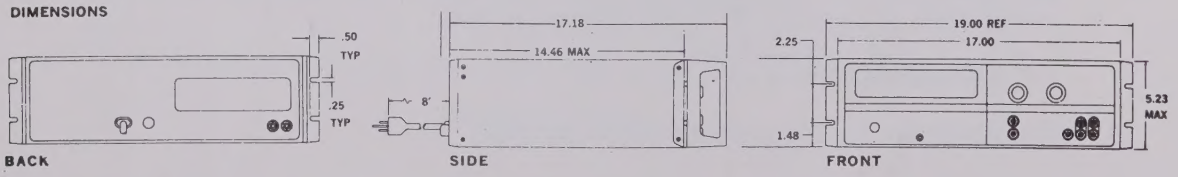
## 1.3 SPECIFICATIONS

Specifications are listed on the following page.

## 1.3 SPECIFICATIONS

| DC VOLTAGE MEASUREMENTS | ABSOLUTE (0 to ± 1000 v) | RATIOS (+1 to +11 v ref std, +10 to +110 available) |
|---|---|---|
| Full scale ranges, ranging and polarity automatic | ±10.999, ±109.99, ±1099.9 v (max input 1000 v) | ±1.0999:1, ±10.999:1, ±109.99:1 |
| Accuracy (90 days) | ±0.01% of reading ±0.01% of f.s. | ±0.01% of reading ±0.01 (10v/E ref)% of f.s. |
| Temperature coefficient | ±0.001% of f.s. per °C | same as absolute |
| Response time: Digitizing with polarity change | 2 milliseconds | same as absolute |
| Range change (READ mode) | 250 milliseconds per range | same as absolute |
| Full scale step function settling time (to 0.01%) | 500 milliseconds with up to 100k-ohm source | same as absolute |
| Common mode rejection: DC | error <0.01% f.s. per 100 v common mode, with up to 100 ohms in either lead | same as absolute |
| AC, 61 Hz and below | error <0.01% f.s. per 10 v common mode, with up to 100 ohms in either lead | same as absolute |
| Normal mode noise rejection | 60 dB min, 59 Hz and up; increasing 18 dB/octave; three-pole Gaussian (55 dB min, 49 Hz and up) | same as absolute |
| Input resistance — at or off null: 10 v range | 1000 megohms | signal, 1000 megohms; ref, 20 megohms |
| other ranges | 10 megohms | signal, 10 megohms; ref, 20 megohms |
| **DV VOLTAGE MEASUREMENTS, FAST** | | |
| Full scale ranges, ranging and polarity automatic | ±10.999, ±109.99, ±1099.9 volts (max input 1000 volts) | |
| Accuracy (90 days) | ±0.01% of reading ±0.01% of f.s. | |
| Temperature coefficient | ±0.001% of f.s. per °C | |
| Response time: Digitizing with polarity change | 2 milliseconds | |
| Range change (READ mode) | 250 milliseconds per range | |
| Full scale step function settling time (to 0.01%) | 15 milliseconds with up to 100k-ohm source | |
| Common mode rejection: DC | error <0.01% f.s. per 100 v common mode, with up to 100 ohms in either lead | |
| AC, 61 Hz and below | error <0.01% f.s. per 3 v common mode, with up to 100 ohms in either lead | |
| Input resistance — at or off null: 10 v range | 1000 megohms | |
| other ranges | 10 megohms | |
| **MILLIVOLT MEASUREMENTS (MODULE 031 ONLY)** | | |
| Full scale ranges, ranging and polarity automatic | ±109.999, ±1099.9 millivolts | |
| Accuracy (90 days) | ±0.01% of reading ±0.02% of f.s. | |
| Response time: Digitizing with polarity change | 2 milliseconds | |
| Range change (READ mode) | 250 milliseconds/per range | |
| Full scale step function settling time (to 0.01%) | 1 second | |
| Common mode rejection: DC | error <0.01% f.s. per 10 v common mode, with up to 100 ohms in either lead | |
| AC, 61 Hz and below | error <0.01% f.s. per 10 v common mode, with up to 100 ohms in either lead | |
| Normal mode noise rejection | 40 dB min, 59 Hz and up; increasing 12 dB/octave (36 dB min, 49 Hz and up) | |
| Input resistance | 100 megohms | |
| **ACCESSORIES (MODULE 031 ONLY)** | **MODEL 29 AC CONVERTER** | **MODEL 07 OHMS CONVERTER** |
| Maximum voltage rating | 500 v rms, 50 Hz to 10 kHz, decreasing to 150 v at 50 kHz and up | not applicable |
| Maximum voltage across unknown | not applicable | 10 v at f.s., max current 10 ma on 1 k range |
| Full scale ranges, ranging automatic | 1.0999, 10.999, 109.99, 1099.9 v rms | 1.0999, 10.999, 109.99, 1099.9, 10999 kilohms |
| Accuracy (90 days): 10, 100, 1000 ranges | 50 Hz to 10 kHz: ±0.08% rdg ±0.02% f.s. | 1, 10 and 100 ranges: ±0.01% of reading ±0.01% f.s. |
| | 10 kHz to 50 kHz: ±0.2% rdg ±0.05% f.s. | 1000 range: ±0.03% of reading ±0.01% f.s. |
| | 50 kHz to 100 kHz: ±0.9 rdg ±0.1% f.s. | 10,000 range: ±0.07% of reading ±0.05% f.s. |
| 1 range | 50 Hz to 10 kHz: ±0.18% rdg ±0.02% f.s. | |
| Response time: Digitizing | 2 milliseconds | 2 milliseconds |
| Range change (READ mode) | 250 milliseconds per range | 250 milliseconds per range |
| Full scale step function settling time | 0.3 second (to 0.1%) | 1, 10, 100 kilohm ranges: 2 sec; 1 meg range: 3 sec; 10 meg range: 2 sec plus 1 sec/meg (to 0.01%) |
| Common mode rejection: DC | not applicable | not applicable |
| AC, 61 Hz and below | error <0.01% f.s. per 10 v common mode, with up to 100 ohms in either lead | not applicable |
| Input resistance (all ranges) | 1 megohm in series with 0.22 microfarad | not applicable |
| Shunt capacitance at terminals | front input: less than 140 pF; Parallel rear input: less than 200 pf. | not applicable |
| **GENERAL SPECIFICATIONS AND ORDERING INFORMATION** | | |
| Measurement rate in READ mode | 4 readings/second | |
| Maximum common mode voltage | 250 volts | |
| Maximum power requirement | 40 watts, 105 to 125 v (export 210 to 250 v), 50 to 400 Hz | |
| Warm up | 1/2 hour to full accuracy | |
| Operating temperature range | 0° to +50°C, accuracy and temperature specs apply from +12° to +50°C. | |
| Weight | 25 pounds (approx) net, 30 pounds (approx) shipping | |
| Analog electrical output | 10 v f.s. at 1 milliamp. Accuracy: dc and ohms, ±1 mv; ac same as Model 29. Output resistance: 5 Ω | |

**DIMENSIONS**




BACK SIDE FRONT

# SECTION 2

# INSTALLATION

## 2.1 UNPACKING AND INSPECTION

The Digital Voltmeter is crated in a plastic foam container consisting of two half-forms joined together and securely taped. The forms are contoured so as to hold the digital voltmeter firmly in place with the container absorbing any reasonable external shock. Before uncrating, examine the container for any sign of external damage.

Carefully cut the tape holding the two half-forms together and remove the digital voltmeter. Inspect the digital voltmeter for signs of damage. If damage is found, notify the carrier immediately.

Remove the two modules from the DVM enclosure by turning the knurled knobs counterclockwise and pulling on the aluminum channel across the front panel of each module. Be sure that all circuit boards are firmly seated in their connectors. Normally, there is no need to remove each board; however, a visual check for obvious damage should be made.

Reseat the modules by pressing them firmly into the connectors at the rear of each drawer assembly. Lock in place by turning the knurled knobs fully clockwise.

The Digital Voltmeter, as shipped, is designed for bench-top operation. A standup bracket is provided under the case to aid in reading the visual display. To adapt the instrument for rack mounting, flanges are attached by removing two screws holding the side panels to the front bezel casting and replacing them with the longer screws provided with the rack-mounting flanges. The flanges are supplied in pairs, with Part No. F-450820 applying to a pair of flanges alone. For integral flanges and carrying handles, specify Part No. FH-450820. For carrying handles only, specify Part No. H-450820.

## 2.2 POWER CONNECTIONS

A standard eight-foot, three-wire, power cable is supplied with the instrument. This cord connects to a three-pin power connector at the rear of the unit.

## 2.3 INPUT/OUTPUT CONNECTIONS

### 2.3.1 Inputs/Analog Output

Signal input and analog output binding posts are located on the front of the digital voltmeter. Binding posts for the reference input, used for ratio measurements,

are located on the rear of the unit. Connection to these terminals is made with standard "banana" plugs. Table 2.1 identifies each connector and mating connector.

Table 2.1. Connector Identification

| Connector | Dana P/N | Mfr. | P/N |
|---|---|---|---|
| Digital Output J202 | 600017 | Amphenol | 57-40500 |
| Mating Connector | 600047 | Amphenol | 57-30500 |
| Rear Input J203 | 600259 | Amphenol | 97-3102A-14S-6S-639 |
| Mating Connector | 600260 | Amphenol | 97-3106A-14S-6P-639 |
| Hood | 601639 | Amphenol | 97-3057-6A-639 |
| Remote Programming J204 | 600017 | Amphenol | 57-40500 |
| Mating Connector | 600047 | Amphenol | 57-30500 |

Models equipped with a rear input connector (designated by a -1 following the Module number; e.g., 030-1) use a six-pin cable connector wired in parallel with the front-panel binding posts. The mating connector is supplied with the instrument. See Paragraph 2.4 for instructions on the use of the analog output. Pin assignments of the rear input connector (J203) are as follows:

| | |
|---|---|
| Pin A | Signal Input + |
| Pin B | Signal Input - |
| Pin C | Ohmmeter Current + |
| Pin D | Ohmmeter Current - |
| Pin E | Shield |
| Pin F | Shield |

### 2.3.2 Remote Programming/Electrical Output

The Remote Programming/Electrical Output Accessory fits into the rear panel of the digital voltmeter. It carries two 50-pin connectors. The connector on the right-hand side (as viewed from the rear) is the digital output connector, J202. The connector on the left is the remote programming connector, J204. Printers and other digital recording devices may be driven by the signals present on the pins of the electrical output connector. Functions and ranges can be selected and remote commands generated through pins of the remote programming connector.

Pin assignments of the two connectors, along with wiring and programming instructions, are included in the "Electrical Output and Programming Accessories" manual.

## 2.4 ANALOG OUTPUT

The analog output at the front panel terminals is ±10 volts full scale for ±DC signals, both volts and millivolts. It is a +10 volt full scale for kilohm measurements and a -10 volt full scale for AC measurements. The full scale analog output voltage is increased by approximately 10% in the overrange condition. The analog output should drive 100,000 ohm load (minimum) for maximum accuracy.

In connecting the analog output to a strip-chart recorder or other analog device, it should be recognized that the black terminal of the analog output pair is internally connected to the black signal-input connector. Ideally, therefore, floating or isolated recorders should be used to avoid ground loop problems.

## 2.5 INITIAL CHECKOUT PROCEDURES

Every instrument is completely checked out and calibrated before leaving the factory. The following procedure is performed to verify that no damage has occurred during shipment and that the instrument is operative. Slight deviations in readings during the following tests may be corrected by making simple adjustments. For instructions, refer to "Field Calibration." Any major discrepancies should be reported to the carrier and to Dana Laboratories immediately.

Prior to performing the checkout procedure, it may be advisable to refer to the Operating Instructions, Section 3.

2.5.1 Zero Check

1. Set FUNCTION control to MV and RANGE to 100.

2. Short input leads. Adjust MV ZERO for a zero reading ±1 digit (000.01).

2.5.2 Polarity Gain Check

1. Set FUNCTION control to DC and RANGE to 10.

2. Apply a known voltage of approximately -10 volts to the input. Visual readout should display value of input voltage and proper polarity indication.

3. Reverse polarity of voltage at input (to approximately +10 volts). Visual readout should again display input voltage and proper polarity.

2.5.3 Range Check

1. Set RANGE to 100.

2. Connect input to a source of +100 volts DC.

3. Visual readout should display input value and proper polarity indication.

4. Vary input voltage and polarity and check for proper readout.

5. Repeat on 1000 volt range.

6. Repeat the above steps with function on mV and using 100 mV and 1000 mV inputs. (Source resistance of mV signals should be less than 2.5 kilohms.)

2.5.4 AC Check

1. Connect signal generator to input. Set FUNCTION switch to AC.

2. Set generator to 50Hz and check for proper readout at the following voltages: 9 volts, 90.0 volts, and 125 volts.

2.5.5 Ohms Check (030 and 031 Modules Only)

1. Measure standard resistors of values near full scale for each range.

2. Check for proper readout and ohms indication.

# SECTION 3

# OPERATION

## 3.1 CONTROLS

### 3.1.1 POWER ON-OFF Switch

This is a pushbutton switch that applies power to the instrument. When Power is ON, the DVM display is always lit. The power switch is independent of both the left- and right-hand drawers. It electrically connects with the power supply at the rear of the instrument.

### 3.1.2 READ/HOLD Switch

This is a two-position switch that allows the operator a choice of a READ mode, in which new readings are commanded at a fixed rate of four per second, or a HOLD mode, which freezes the last previous reading indefinitely. HOLD is released by turning the switch back to the READ position.

### 3.1.3 FUNCTION Switch

This is a seven-position switch having the following positions:

1. REMOTE. In REMOTE, the selection of the function to be measured is made externally through the Remote Programming input.

2. FAST DC. This position selects high-speed, non-filtered DC measurements from 1mV to 1000 volts.

3. DC. This position selects medium-speed DC measurements from 1mV to 1000 volts. An input filter is installed in the circuit in this position.

4. 10X RATIO. This position selects the measurement of the ratio of the input voltage, applied across the input signal terminals, to a reference voltage, applied to the reference input terminals at the rear of the instrument. The input voltage is amplified by a factor of 10. Therefore, a 1:1 ratio is displayed as 10 rather than 1.

5. AC. This position selects the measurement of AC voltages from 50Hz to 100 kHz.

6. MV. This position selects the measurement of low-level DC voltages from 10 microvolts to 1000 millivolts.

7. K-OHM. (On 030, 031 Modules only). This position selects the measurement of resistance from 1 ohm to 10 megohms.

### 3.1.4 RANGE Switch

The RANGE switch has five fixed range positions, an AUTO position, and REMOTE.

Fixed Ranges. The five fixed ranges are 1, 10, 100, 1000, and 10,000. Inscriptions on the panel define the ranges which can be used with particular functions. The ranges for each function are summarized in the following:

| Function | Ranges | | |
|---|---|---|---|
| | Model 020 | Model 030 | Model 031 |
| DC - DC FAST | 10, 100, 1000 | 10, 100, 1000 | 10, 100, 1000 |
| MILLIVOLTS | 100, 1000 | 100, 1000 | 100, 1000 |
| KILOHMS | | 1, 10, 100, 1000, 10,000 | 1, 10, 100, 1000 10,000 |
| AC | 10, 100, 1000 | 10, 100, 1000 | 1, 10, 100, 1000 |

AUTO (Automatic). In this position, range is automatically selected by internal circuits.

REMOTE. In this position, the selection of range is made externally through the Remote Programming input.

## 3.2 MANUAL OPERATION

The Dana Digital Voltmeter has been designed for the simplest possible level of operation. Once the instrument has been connected to the power line and to the signal source in accordance with the instructions in Section 2, the operator can make all the required measurements by setting the front panel manual controls to the indicated positions.

When switching from one type of measurement to another by turning the FUNCTION control, it is generally advisable to keep the RANGE switch on AUTO so as to avoid overloading the input circuitry. Also, care should be taken to avoid introducing more than 500 volts into the instrument while the FUNCTION switch is on AC, or more than 30 volts while the FUNCTION switch is on MV.

> CAUTION
>
> Do Not apply voltage to analog output terminals. Voltage applied between ground and the low input terminal must not exceed 250 volts.

The digitizing time is so rapid that no bothersome flicker occurs on the digital voltmeter display between the four-per-second readings in the "read" mode. With a constant input signal, the display appears to remain fixed. It is therefore normally most convenient to leave the READ/HOLD control on the READ position, using the HOLD position only for special applications, such as external command operation.

### 3.2.1 DC Measurements, Fast, Normal, and Millivolt

Attach the high side of the signal source to the white signal input terminal, the low side to the black signal input terminal. Normally the ground terminal (which is at the DVM chassis ground) is jumpered to the black signal input terminal. If the input signal cable has a shield, this should also be attached to the black signal input terminal. To operate the DVM on a floating basis, detach the ground terminal from the black input signal terminal.

### 3.2.2 AC Measurements

Attach the high side of the signal source to the white signal input terminal, the low side to the black signal input terminal.

Normally the ground terminal (which is at the DVM chassis ground) is jumpered to the black signal input terminal.

### 3.2.3 Ratio Measurements

Attach the signal input as for the DC instructions above. Attach the +DC reference voltage with the positive side to the white EXT REF terminal on the rear panel of the instrument. The black EXT REF terminal is tied internally to the black signal input terminal, and this is normally jumpered externally to the ground terminal, which is at DVM chassis ground.

Because the black terminals are tied together, the instrument can by itself make only three-wire ratio measurements (i.e., the reference and signal voltage have a joint common). For four-wire ratio measurements, use a differential amplifier, such as the Dana 3400 or 635.

### 3.2.4 Ohms Measurements

For two-wire ohms measurements, jumper the white ohmmeter current source terminal to the white signal input terminal, and the black source terminal to the

black signal input terminal and the ground terminal. The signal leads to the unknown resistance may be connected to either set of terminals.

For increased accuracy of low ohms measurements reducing the effect of lead resistance, separate sets of leads are connected to the non-jumpered signal input and ohmmeter-current source terminals. These leads are connected to the unknown resistance in the low ohms lead must be limited to 1 ohm for maximum accuracy.

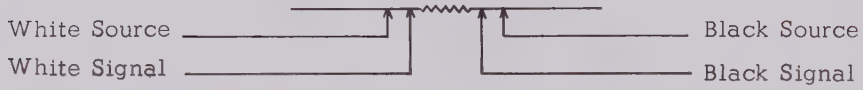



Figure 3.1. Four-Wire Ohms Measurements

## 3.3 REMOTE PROGRAMMING

The Digital Voltmeter may be operated by remote commands or by a combination of front panel manual controls and remote commands. Refer to the "Electrical Output and Programming Options" manual for instructions.

## SECTION 4

## THEORY OF OPERATION

### 4.1 INTRODUCTION

This section covers the theory of operation of the Accessory Module. Refer to the basic DVM manual for theory of operation of the Digitizing and Display Module. The Accessory Module supplies a negative 10-volt full scale input voltage to the Digitizing and Display Module. This voltage is converted to a precise current and balanced against a current derived from a known fraction of a fixed reference voltage.

A functional diagram showing the circuits in the Accessory Module (Figure 4.4) appears on the last page of this section. The page may be unfolded allowing the diagram to be referenced while reading the circuit descriptions throughout the section. The diagram is intended to supplement the complete schematics included in Section 6. In this section, a description of each circuit board is followed by a description of the measurement configuration of each function. Dana logic symbols are defined in Figure 4.1

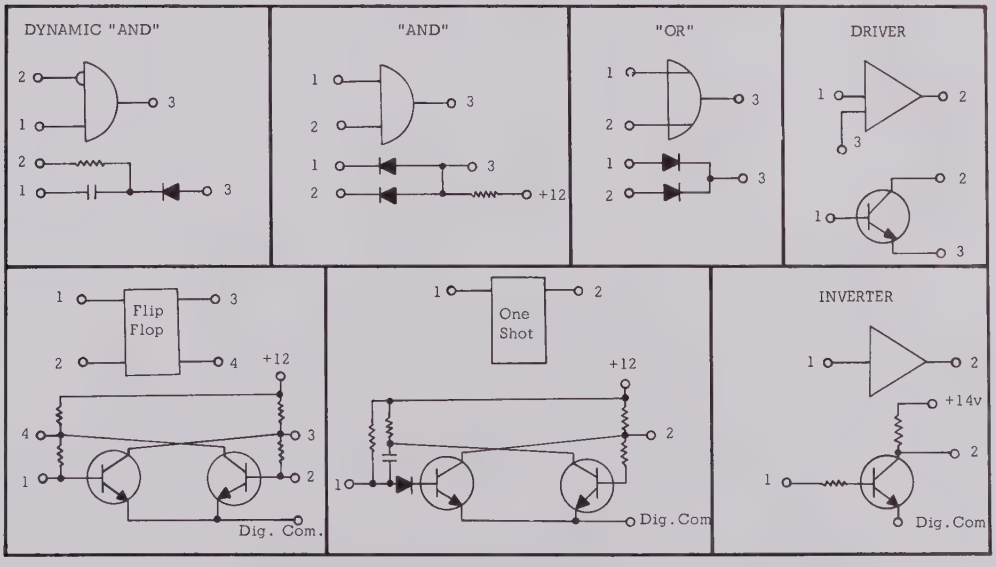



Figure 4.1. Dana Logic Symbols

## 4.2 CIRCUIT DESCRIPTIONS

### 4.2.1 Control and Attenuator

020 Module: Schematic 430464
030 Module: Schematic 430310
031 Module: Schematic 430610

The Control and Attenuator is the first assembly behind the front panel. On it are mounted the front panel switches and input/output terminals. The board contains relays which switch polarity, function, and range displays; filters; scaling resistors; and an attenuator for millivolt measurements. The relays are controlled by the function selection — from either the front panel switch or through remote programming — and by the range signals — from either the RANGE switch, through remote programming, or from the Range Control. The board also carries the logic circuits necessary to translate the local and remote commands into the appropriate relay responses.

Six relays, K1 through K6, are used. K1 is shown on sheet 1 of the schematic; the others are shown on sheet 2. One side of each relay coil is tied to +28V; the relay is energized by applying a digital common level to the opposite side. The purpose of each relay is indicated in the following table.

| Relay | Energized by: | Purpose |
|---|---|---|
| K1 | DC, Ratio selected | Adds active filter to the input. |
| K2 | Kilohms selected | Routes "current source" directly to Ohms Converter. |
| K3 | AC selected | Switches high side of input directly to the AC Converter; switches active AC filter into the circuit. |
| K4 | MV selected | Switches passive filter into circuit; adds 10K feedback loop to Isolator and adds resistance network to ground. |
| K5 | All functions except DC on 100 and 1000 Range | Range switching |
| K6 | All functions except Kilohms on 100 Range | Range switching |

### 4.2.2 Isolator (Schematic 430305)

The Isolator is a floating-input differential amplifier capable of operating at very low signal levels. The feedback loop, that establishes amplifier gain, is located on the Control and Attenuator board. The feedback circuit and the amplifier input are switched into various configurations to conform to the function selected. The amplifier operates as a unity-gain isolator for DC, ratios, and resistance measurements (030-031 only); as a gain of 10 amplifier for AC measurements; and as a preamplifier for millivolt measurements on the 100 and 1000 ranges.

Operating in conjunction with the Isolator amplifier is a "bootstrap" amplifier (consisting of Q5, Q6, Q8, Q10, Q11, and Q15, see schematic). This amplifier samples the voltage at the negative feedback point and adjusts the supply voltages to the input stage so that base and collector voltage remain constant. Also it provides a reference level for the first stage base current compensation network.

### 4.2.3 Auto Polarity (Schematic 430304)

The Auto Polarity board eliminates the need for polarity switching by maintaining (in conjunction with the Isolator output) a negative input to the Digitizing and Display module regardless of the polarity of the input. The circuit consists of an inverting amplifier with polarity dependent feedback paths. The input resistor and feedback resistors are equal, resulting in unity gain.

The input to the Auto Polarity board from the Isolator is of the same polarity as the input. It is scaled to 10 volts, full scale. A positive input to the Auto Polarity amplifier produces an equal negative voltage on the negative feedback path and zero volts on the positive path; a negative input voltage produces zero voltage on the negative path and an equal positive voltage on the positive feedback path. The input to the Null Detector is taken from only the negative feedback path. Therefore, the voltage at the positive gain trimming resistor is either zero (with negative input) or -10 volts full scale (with positive input).

With AC function selected, the input to the Auto Polarity board is from the AC Converter rather than from the Isolator (K3 on the AC Converter is energized) and the circuit operates as a full-wave rectifier. The in-phase AC from the AC Converter is summed with the half-wave rectified (and $180^{\circ}$ out of phase) Auto Polarity output. An active filter is connected through the relay contacts of K3 on the Control and Attenuator and the circuit configuration is rearranged as described under "AC Measurement", paragraph 4.6.

### 4.2.4 Range Control

020 Module: Schematic 430501
030 Module: Schematic 430501
031 Module: Schematic 430608

Range changes in the instrument are determined by the BCD state of the Decades in the Digitizing and Display Module and controlled by the range signals R1,

R2, R3, and their complements. These signals are the outputs of a three-stage counter on the Range Control circuit board. The counter counts up or down in response to logic at the input which depends on the function selected. If the decades are not at full scale (10999), the Count Up signal is inhibited by the lines from the Decades. If the state of the decades is not at one-tenth scale or less (01000), the Count Down signal is inhibited. The circuit arrangement of the inhibit lines is shown in Figure 4.2.

The Count Up and Count Down lines are clamped by diode gates on the decades when a change (either up or down) in the range counter is to be inhibited. An "up" range is allowed only when the Overflow flip-flop on the Control Logic board is set and the three lower-order decades are at nine — indicating 10999. In addition to this count, an "up" from the Trigger flip-flop is also required. At any count other than 10999, the Count Up signal is clamped to common by one or more of the diodes in the 0's or 9's gates on the Decade boards or diodes on the Overflow flip-flop output.

A "down" range is allowed only when the count is less than 01000. This is indicated by the Overflow flip-flop "off" and the 0's gate from the 1K decade "true". At other counts, the Count Down range signal is inhibited.

The Count Up Range and Count Down Range signals have no effect on the counter except when the output of the Start/Stop Memory (S/S) one-shot is "true". This occurs when the S/S signal (generated in the Digitizing and Display module) goes "false" at the end of a digitizing process. The count signals can be inhibited also by the "forbidden range" logic explained in the following paragraphs. Normally the counter will count up as shown in the following table.

| States | | | Range |
|---|---|---|---|
| R1 | R2 | R3 | |
| 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 10 |
| 0 | 1 | 0 | 100 |
| 1 | 1 | 0 | 1000 |
| 0 | 0 | 1 | 10,000 |

Since all ranges are not used for all functions, logic is present to prevent the counter from remaining on a prohibited range for a particular function. For example, with the Millivolt function selected, R2 is not allowed to reset and R3 is held "off" by the MV line applied to R2 and R3 through diodes CR37 and CR38. This allows only the 100 and 1000 ranges to be available with this function selected. Similarly, with the counter at 110 representing the 1000 range,

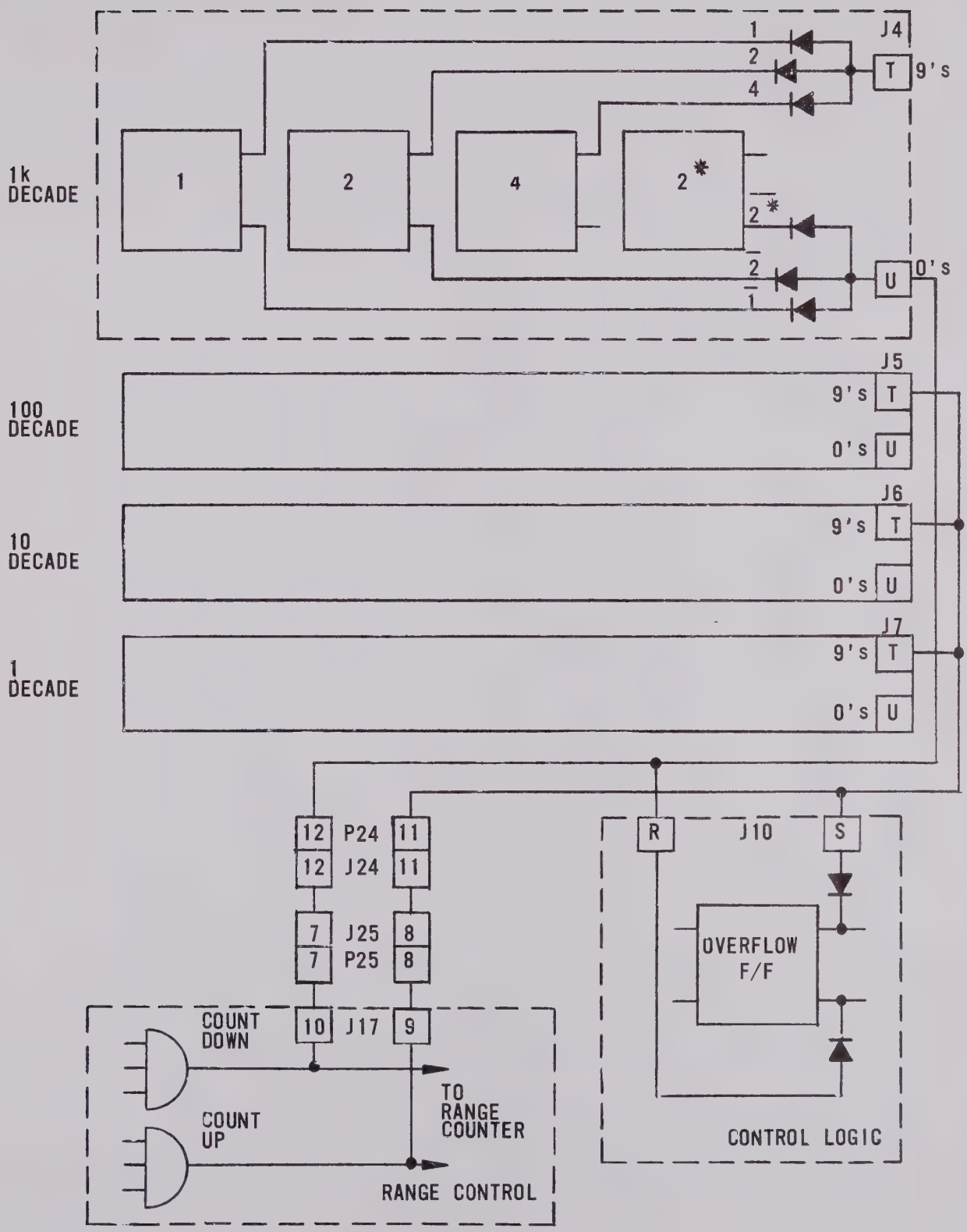



Figure 4.2. Range Counter Inhibit Circuit

a count-up pulse is inhibited unless the Kilohm function is selected — since that is the only function using the 10,000 range. The input line labeled Z is "false" when either AC, DC, DCF, or Ratio is selected. This line prevents the R3 flip-flop from setting — thereby skipping the 10,000 range.

Any fixed range, selected either manually or remotely, inhibits the automatic range function. This is done by the five-input "and" gate that receives the range signals.

4.2.5 AC Converter

020 Module: Schematic 430306
030 Module: Schematic 430306
031 Module: Schematic 430609

The AC Converter is an accessory board that may be plugged into the designated position in the Module at any time. No special wiring is required; however, recalibration is required. The Converter in Modules 020 and 030 is designated as Model 27; this is a three range Converter. In Model 031, Model 29 Converter is used; Model 29 provides four ranges. Each AC Converter consists of an AC-coupled, wideband, low-level amplifier with one permanent feedback path for the low range and shunt networks that are switched into the circuit by reed relays for the other ranges. The unit is an operational amplifier, with resistor-capacitor pairs at the input and on the feedback loop. The full-scale output on all ranges is approximately 3 volts rms for a 10-volt rms input signal.

The output is applied to the Auto Polarity Amplifier which, in AC mode, serves as a full wave rectifier. Relay K3 is energized when AC is selected. It reroutes signals from the Isolator and Auto Polarity boards to obtain the proper circuit configuration for the measurement of AC volts.

4.2.6 Ohms Converter (Schematic 430303; used in Modules 030-031 only)

The Ohms Converter board produces a constant and precise current which passes through the unknown resistance. The voltage drop across the resistance is determined by the voltage measuring circuits and displayed in Kilohms. The principal circuit element on the Ohms Converter board is a bridge differential amplifier. The voltage across the input terminals is the 10-volt buffered internal reference generated in the Digitizing and Display module, referenced to the Isolator amplifier output. The output of the Ohms Converter amplifier is directed to the Isolator input through a network of current-determining "full-scale" resistors. The effect is to maintain a constant 10 volts across the full-scale resistors, regardless of the output of the Isolator amplifier. A 10-meg range resistor is constantly in the circuit. The other four resistors are inserted in parallel by the range relays.

## 4.3 DC AND RATIO MEASUREMENT

The circuit configuration used for the measurement of DC volts is shown in Figure 4.3a. An identical arrangement is used when the instrument is in the ratio-measuring mode. The difference in these two types of measurements lies in the counter-balancing reference used in the Digitizing and Display module. DC volts are measured against a fixed internal reference; ratios are measured against an external reference.

As explained previously, the purpose of the Signal Conditioning module is to produce a negative 10-volt full scale signal (-10.999, including over-range) at the input of the Digitizing and Display module. The negative voltage is applied across precision resistors to produce a current that is nulled by an opposite current generated by the reference voltage.

The first step is to scale the incoming DC signal to 10 volts full scale. The precision scaling resistors in the Control and Attenuator circuit divide the input voltage by 10 if the signal is between $\pm$10.999 and $\pm$109.99 volts, and by 100 if the signal is between $\pm$109.99 and $\pm$1,000 volts. The 10-volt full scale input is then filtered to remove superimposed noise and fed into the input of the Isolator. The Isolator is, in this mode, a unity gain amplifier. Its output is therefore identical in polarity and amplitude with the scaled input. The voltage is directed in parallel to two destinations: the input to the Null Detector via a 5,000-ohm resistor, and the input to the Auto Polarity amplifier.

Field calibration includes trimming of the 5,000- and 2,500-ohm resistances at the Null Detector input by adjusting potentiometers on the Isolator and Auto Polarity boards (Polarity Gain adjustments). With a negative standard voltage input, only the Isolator voltage to the Null Detector is involved; the negative Polarity Gain adjustment on the Isolator is therefore calibrated first. When a positive standard-voltage input is applied, both current sources are contributing to the Null Detector input and, since Negative Polarity Gain has already been calibrated, the Positive Polarity Gain on the Auto Polarity board is adjusted for positive input voltages.

It is important to note that the Positive Polarity Gain adjustment is used to calibrate positive input voltages; however, the actual polarity voltage affected by this adjustment is always negative (or zero). By contrast, the Negative Polarity Gain adjustment is dealing with the Isolator output, which may be positive or negative, depending on the polarity of the input signal

## 4.4 FAST DC MEASUREMENT

When Fast DC measurements are being made, the configuration of the Signal Conditioning module is the same as for DC measurements except that the Active Filter is removed. Elimination of the filter allows the instrument to settle to within 0.01% of the final reading in 10 milliseconds, after a step-function change

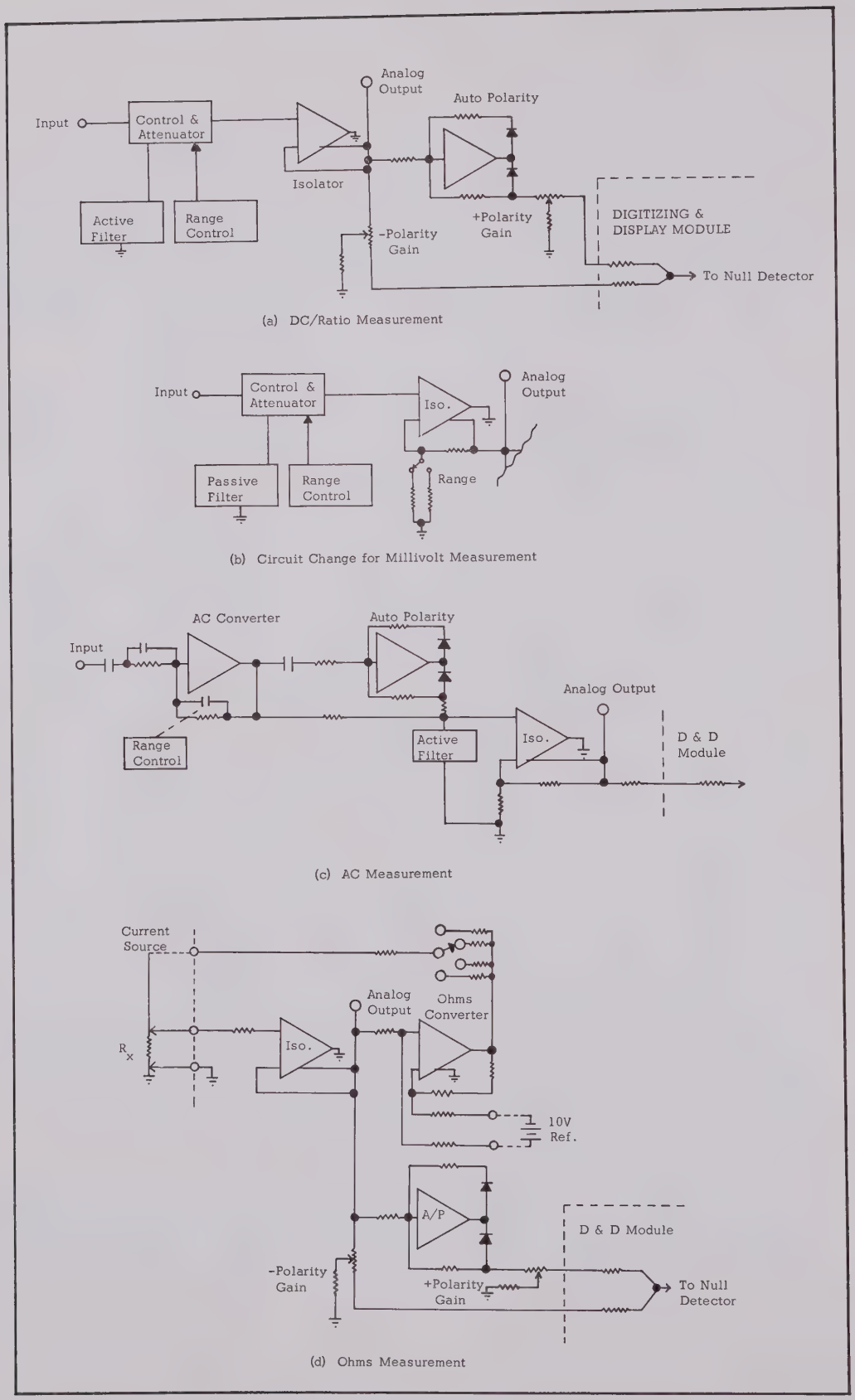



Figure 4.3. Block Diagram

in input level. The filter slows the settling time down to 250 milliseconds. Other than this change at the input, the fast DC mode is identical to that of the standard DC and ratio measurements.

## 4.5 MILLIVOLT MEASUREMENT

The selection of Millivolts "expands the scale" by switching the function of the Isolator circuit, changing it to a preamplifier. Figure 4.3b illustrates the change in configuration from that shown in Figure 4.3a.

A 10-kilohm feedback loop is added to the amplifier. This, in conjunction with a resistance network to ground, switches the gain of the amplifier to either 10 or 100. At a gain of 10, the instrument is operating at 1,000 millivolts full scale; at a gain of 100, the full scale is 100 millivolts and the last digit resolution is 10 microvolts.

A passive filter is used at the input to attenuate superimposed noise. Otherwise, the balance of the millivolt circuitry is identical to that used in measuring DC volts and ratios.

## 4.6 AC MEASUREMENT

The measurement of AC volts involves the addition of the AC Converter Amplifier and a major reorganization of the balance of the circuitry (Figure 4.3c). The AC input signal is applied directly to the capacitor-coupled AC Converter Amplifier. The principal purpose of this amplifier is to scale the input down so that the output of the stage is approximately 3 volts rms for a 10-volt rms, full-scale input signal. Input voltages in the 10-to-100 and 100-to-1,000 ranges are reduced by factors of 10 and 100, respectively.

The scaled-down voltage is applied to the Auto Polarity amplifier, which rectifies it and produces a negative voltage that is approximately $1/\pi$ of the input. A 10-volt rms full-scale input to the instrument is now reduced by exactly 1/10, to -1 volt The half-wave rectified output of the Auto-Polarity circuit is "summed" with the AC Converter output to produce a one-volt full-wave signal. (The "weight" of the Auto Polarity output is twice that of the AC Converter and $180^{\circ}$ out of phase with it.)

The output of the Auto Polarity amplifier is filtered by an active filter on the Control and Attenuator Assembly board and then applied to the Isolator, which has been set to a gain of 10 (using the feedback resistors and attenuators that established the 1,000-millivolt range in the mV mode). The amplified negative voltage is, at this point, a 10-volt full-scale analog of the rms value of the AC input. It is fed directly to the current-determining 5,000 ohm resistor at the input to the Null Detector.

## 4.7 OHMS MEASUREMENT

The ohms measurement configuration of the Signal Conditioning module is similar to that used in the measurement of DC volts and ratios. The Ohms Converter board has the primary function of generating a constant and precise current, which is then passed through the unknown resistor. The DC-measurement circuits determine the voltage drop and display the result as kilohms.

Figure 4.3d illustrates how the ohms converter is tied into the balance of the circuitry. The "constant" voltage applied across the full scale resistors is, in effect, the 10-volt reference voltage used in the null balance circuitry in the Digitizing and Display module. It is "bootstrapped" to the Isolator output resulting in a constant 5 volts across the selected half scale resistor. The value of the range resistor is scaled to the constant five volts so that an unknown resistance of full scale value will develop ten volts. For example, on the 1000 range, the range resistor is 500 ohms and a 10ma constant current results. An unknown resistance of 1000 ohms produces a ten-volt input to the Isolator (0.010 x 1000 = 10).

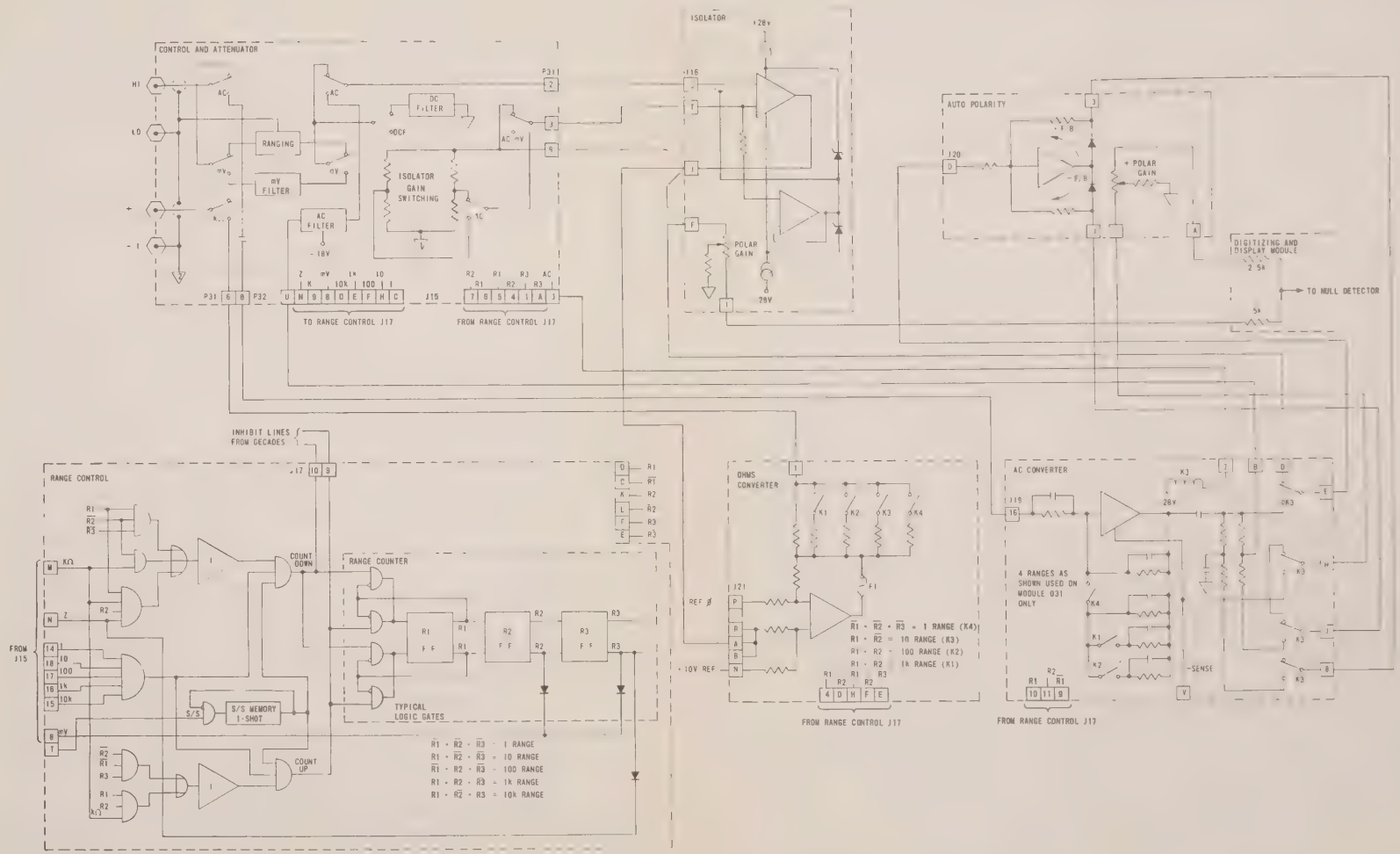



Figure 4.4 - Functional Intraconnection - Modules 020/030/031.

## SECTION 5

## MAINTENANCE

### 5.1 GENERAL

5.2. Field calibration of the instrument is designed to keep the instrument operating within its specifications for indefinite periods of time. Also included are the more detailed calibrations performed at the factory or following major repairs.

5.3. Access to the adjustments is from the top, requiring that the top cover of the instrument be removed. Figure 5.1 illustrates all calibration points involved.

### 5.4 FIELD CALIBRATION

5.5. Equipment required for field calibration is limited to precision DC and AC voltage sources and a set of standard resistors.

### 5.6 ZERO CALIBRATION

(a) Switch FUNCTION Control to millivolt and range to 100.

(b) Short input leads.

(c) Adjust Zero Control (through front panel hole) until the display reads 000.00.

### 5.7 MINUS AND PLUS POLARITY GAIN

(a) Switch FUNCTION Control to DC and range to 10.

(b) Connect input leads to known negative voltage near -10 volts.

(c) Adjust Minus Polarity Gain adjustment (R6) on Isolator Board until the display reads value of known voltage.

(d) Reverse polarity of input.

(e) Adjust Plus Polatiry Gain adjustment (R3) on Auto Polarity board until the display reads value of known voltage.

### 5.8 RANGE CALIBRATION – VOLTS

(a) Switch range to 100.

(b) Connect input leads to ±100 volt source.

(c) Adjust 100 volt range adjustment (R42) on Control & Attenuator board until the display reads value of known voltage.

(d) Switch range to 1000 and repeat first two steps above with ±1000 volt source and 1000 volt range adjustment, R44.

### 5.9 RANGE CALIBRATION – MILLIVOLTS

(a) Switch FUNCTION Control to millivolts.

(b) Short input leads and check that instrument is still zeroed.

(c) Repeat steps in 5.8 using ±100mV and ±1000mV sources and adjusting the 100 mV and 1000mV adjustments (R36 and R38) on Control and Attenuator board.

### 5.10 AC CALIBRATION (Module 020, 030)

(a) Switch FUNCTION Control to AC and range to AUTO

(b) With AC board on extender, adjust capacitor C22 to middle of its span (see Figure 5.1).

(c) Connect input leads to the following series of AC voltages and frequencies, adjusting the indicated adjustment until the instrument displays the known voltage value:

| Volts, RMS | Frequency | Adjustment (Figure 5.1) |
|---|---|---|
| 125.00 | 400 Hz | R20 |
| 125.00 | 50 kHz | C2 |
| 9.0000 | 400 Hz | R18 |
| 9.0000 | 50 kHz | C8 |
| 125.00 | 50 kHz | C22 |
| 90.000 | 400 Hz | R19 |
| 90.000 | 50 kHz | C10 |

(d) When all adjustments are completed, check accuracy of ranges at 50 Hz, using voltage inputs of approximately 9.0, 90.0, and 125 volts.

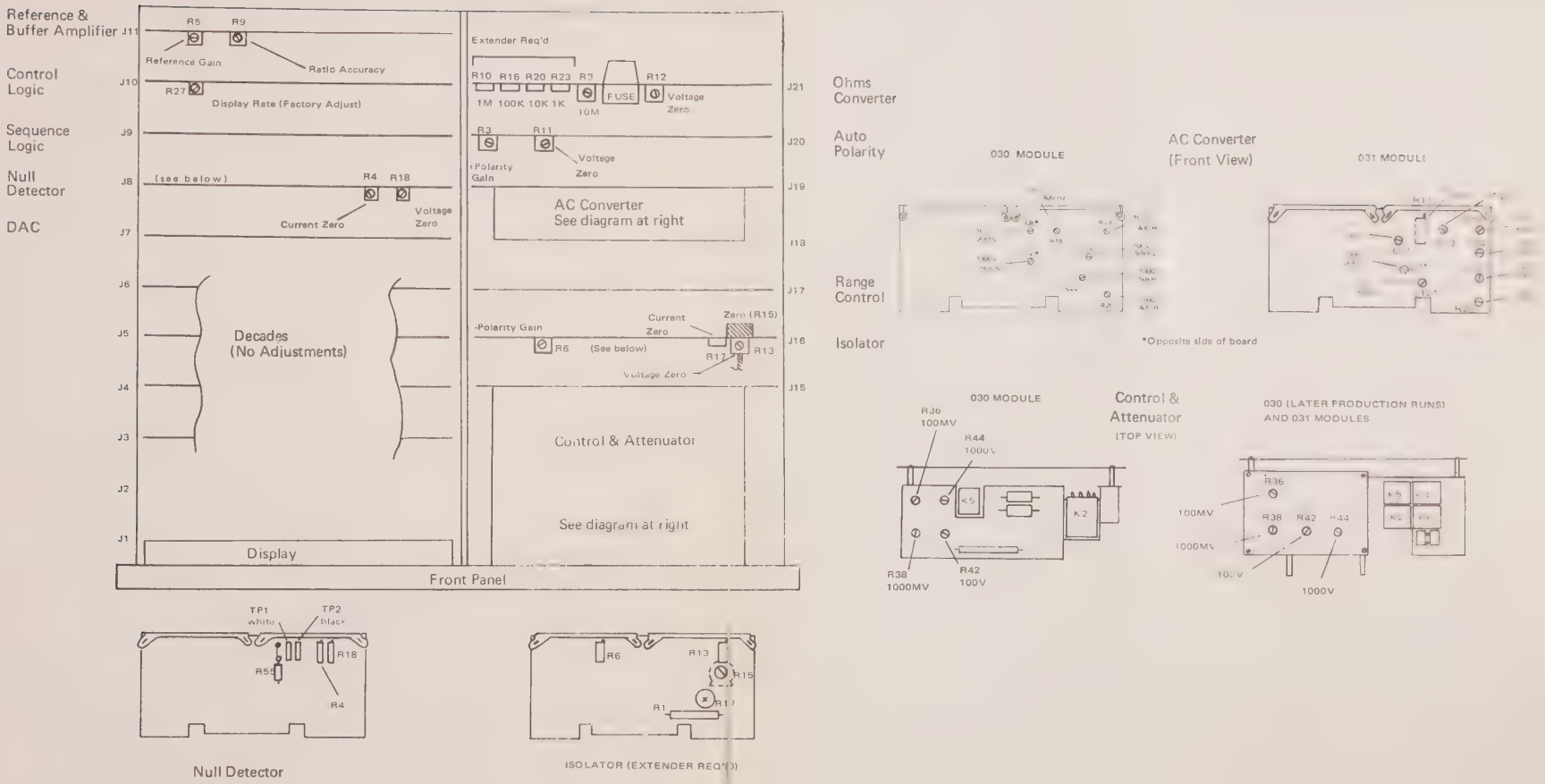



Figure 5.1. Adjustment Locations

### 5.11 AC CALIBRATION (Module 031)

(a) Switch FUNCTION Control to AC and range to AUTO.

(b) With AC board on extender, adjust capacitor C22 to middle of its span.

(c) Connect input leads to the following series of AC voltages and frequencies, adjusting the indicated adjustment until the instrument displays the known voltage value:

| Volts, RMS | Frequency | Adjustment |
|---|---|---|
| 125.00 | 400 Hz | R20 |
| 125.00 | 50 kHz | C2 |
| 0.90000 | 400 Hz | R11 |
| 0.90000 | 10 kHz | C8 |
| 9.0000 | 400 Hz | R13 |
| 9.0000 | 50 kHz | C12 |
| 0.90000 | 10 kHz | C8 |
| 9.0000 | 50 kHz | C12 |
| 90.000 | 400 Hz | R19 |
| 90.000 | 50 kHz | C24 |
| 125.000 | 50 kHz | C22 |

(d) When all adjustments are completed, check accuracy of ranges at 50 Hz, using voltage inputs of approximately 0.9, 9.0, 90.0, and 125 volts.

### 5.12 KILOHM CALIBRATION (Modules 030, 031 only)

(a) Switch FUNCTION to KILOHMS and range to AUTO.

(b) Connect input to a 10-megohm standard and adjust the 10-megohm range adjustment (R3) on Ohms board until the instrument displays correct value.

(c) Repeat with standard resistors near full scale of remaining four ranges, adjusting appropriate controls (R10, R16, R20, and R23) on Ohms board to produce correct values on the display.

### 5.13 RECALIBRATION

5.14. The following procedures are used for the more detailed calibration normally performed after repair of the instrument. Equipment required includes:

Microvoltmeter - Medistor A-60RB or equivalent

Dekavider - ESI Model RV622A or equivalent (six dial)

DC Supply. - Fluke 332A or equivalent

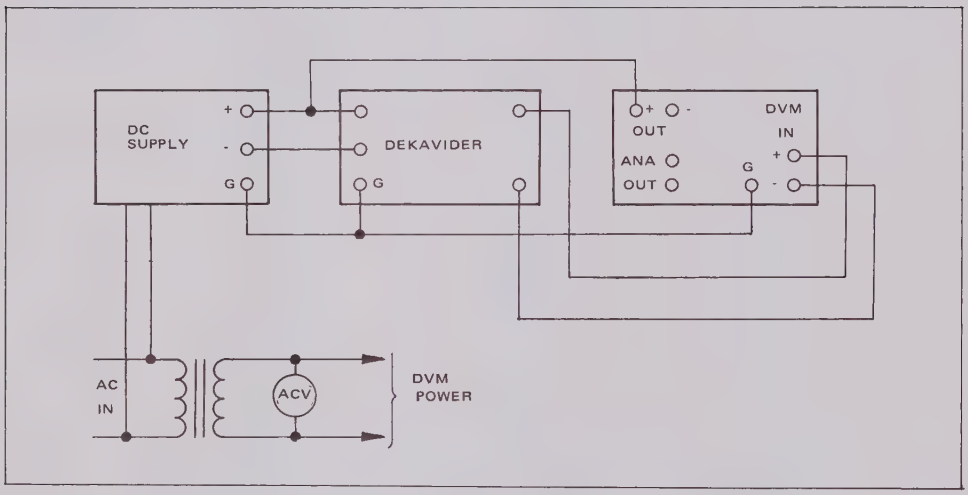



Figure 5.2. Test Setup

## 5.15 PREPARATION FOR TEST

(a) Apply power to DVM and test equipment; allow one-half hour for warmup.

(b) Remove top cover of DVM.

## 5.16 PRELIMINARY ZERO ADJUSTMENT

(a) Adjust line voltages to exactly 115 volts. Set FUNCTION to DC, RANGE to 10.

(b) Attach jumper wire from TP2 to the top of R55 on Null Detector.

(c) Turn R18 in a clockwise direction until the DVM displays random numbers; then return in a counterclockwise direction until the display just reads all zeros. Remove power to the DVM.

(d) Remove jumper; remove Null Detector board from extender and replace in normal position in DVM.

## 5.17 FINAL ZERO ADJUSTMENT

(a) Short DVM input leads. Select MV function and 100 range. Connect microvoltmeter to ANALOG OUTPUT terminals.

(b) Place Isolator board on extender. Apply Power. Set R15 on Isolator to the center of its mechanical span. Adjust R13 until the microvoltmeter reads zero $\pm$100 uvolts.

(c) Set FUNCTION to DC and range to 10. Adjust R17 until the microvoltmeter again reads zero, $\pm$ 100 uvolts. Remove power to DVM.

(d) Replace Isolator in DVM and switch the DVM function to millivolts. Correct any discrepancy from zero on the microvoltmeter by adjusting the MV ZERO control on front panel.

(e) Connect test setup as shown in Figure 5.2. Connect microvoltmeter to ANALOG OUTPUT terminals. Set DC power supply to -10 volts; adjust Dekavider until the microvoltmeter reads -2.0 millivolts.

(f) Adjust R4 on Null Detector board until the display "bounces" between -1 and -2 digits.

(g) Reverse polarity of the DC power supply voltage to obtain 10.0 volts.

(h) Adjust Dekavider until the microvoltmeter reads +2.0 millivolts.

(i) Adjust R11 on Auto Polarity board until the display bounces between +1 and +2 digits.

(j) Repeat steps (e) through (i) to correct for interaction between adjustments.

## 5.18 RATIO LINEARITY ADJUSTMENT

(a) Connect the test setup shown in Figure 5.2. Set FUNCTION switch to Ratio mode, range to 10.

(b) Set power supply output to +10.0 volts. Set the Dekavider to 0.999000. Record the reading as displayed.

(c) Decrease power supply voltage to 1.0 volt. Adjust R9 on Reference Buffer circuit board until the display equals the value recorded in (b).

(d) Repeat steps (b) and (c) until there is less than four digits change in the reading when the power supply voltage is changed from ten volts to one volt.

## 5.19 ± POLARITY GAIN ADJUSTMENT AND RATIO ACCURACY

(a) Connect test setup as shown in Figure 5.2. Set power supply voltage to +10 volts ±100 uV. Set the Dekavider to 0.99900.

(b) Adjust R3 on the auto polarity board to the point where the display "bounces" between +9.998 and +9.999 on 10-volt range.

(c) Place FUNCTION switch to DC. Adjust R5 on reference buffer to the point where the display "bounces" between +9.998 and 9.999.

(d) Reverse input leads. Adjust R6 on the Isolator board to the point where the display bounces between -9.998 and -9.999.

(e) Reverse input leads to DVM. Adjust R3 on the Auto Polarity board for the reading in step (b).

(f) Place FUNCTION switch to RATIO. If the display is not "bouncing" between +9.998 and +9.999 ±0.5 digit, repeat steps (b) through (f).

(g) Check accuracy of the above adjustments with line voltage to the instrument varied from 100 to 130 volts (rms).

5.20. Refer to 5.8 for 100- and 1000-volt range calibration; refer to 5.9 for MV calibration.

## 5.21 TROUBLESHOOTING

## 5.22 GENERAL

5.23. Transistor failures are easily located by use of a portable bench-type VOM. By checking the forward and back resistance of transistor junctions, conditions of leakage or opens and shorts are quickly found. Slight variations in ohmic readings

are normal. Large variations between emitter base and base collector junctions indicate the transistor is bad. In most cases, the effect of loading by circuitry in parallel with a junction being measured can practically be eliminated by using the lowest resistance scale on the VOM.

5.24. The checking of voltage levels with power applied to the circuit offers the most practical approach to locating marginal transistors. Poorly operating stages cause a definite shift in bias level for adjoining circuits. In closed loop amplifiers such as the Reference and Buffer amplifier, this shift causes all circuits to change operating levels. By setting the DVM to RATIO (if not available, connect pin N to Digital Common), shorting the EXTERNAL REFERENCE, and shorting the two bases of the input transistor together, bias levels should be near normal and the malfunctioning stage becomes apparent.

### 5.25 POWER SUPPLY

| | P29 | Nominal Value | Tolerance |
|---|---|---|---|
| +300 Volts | 9 | +300 | ±10% |
| + 28 Volts | 6 | +30 | ±150 mV |
| + 18 Volts | 5 | +19 | ±1 mV |
| + 14 Volts | 3 | +13 | ±1 mV |
| Analog Common | 4 | +2.1 | +1 mV |
| ±Sense Common | 1 | +2.1 | ±1 mV |
| - 18 Volts | 7 | -15 | ±1 mV |
| - 28 Volts | 8 | -30 | ±150 mV |
| Digital Common | 2 | All readings are referenced to this point | |

Values shown are under normal loaded conditions with a line voltage of 115 VAC at 60 Hz.

### 5.26 TROUBLESHOOTING CHARTS

5.27. Some of the more common malfunctions are covered in the troubleshooting charts, Figures 5.3 through 5.7.

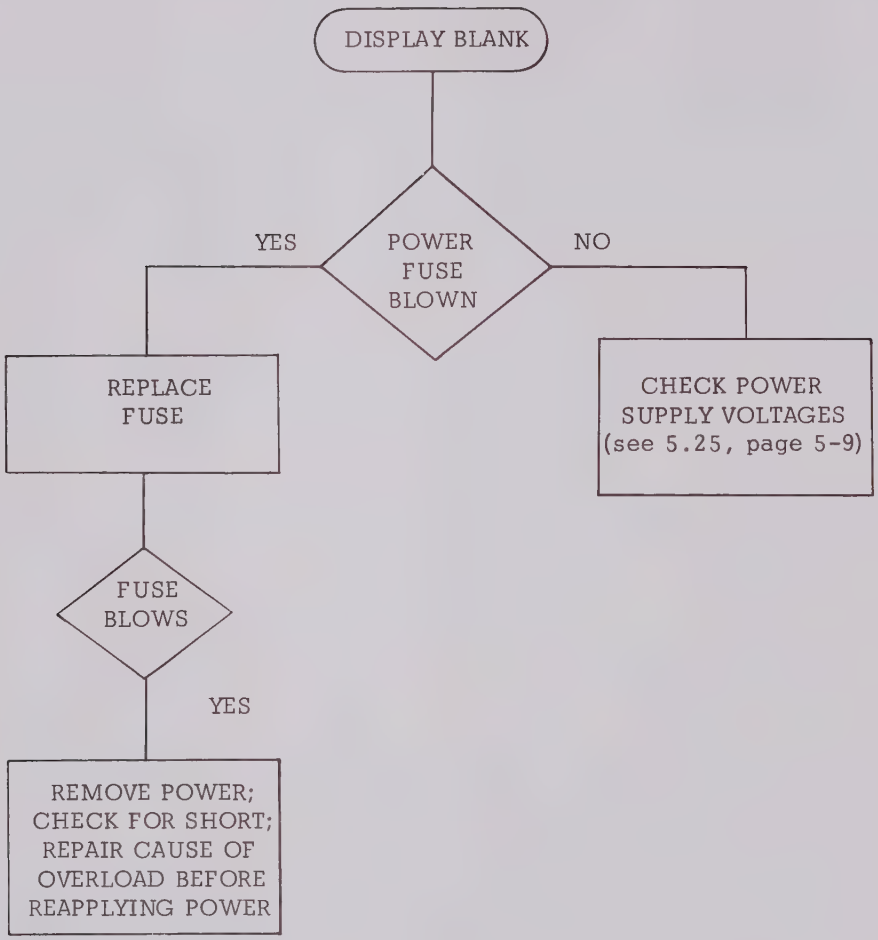



Figure 5.3. Display Blank

FUNCTION = DC
RANGE = 10

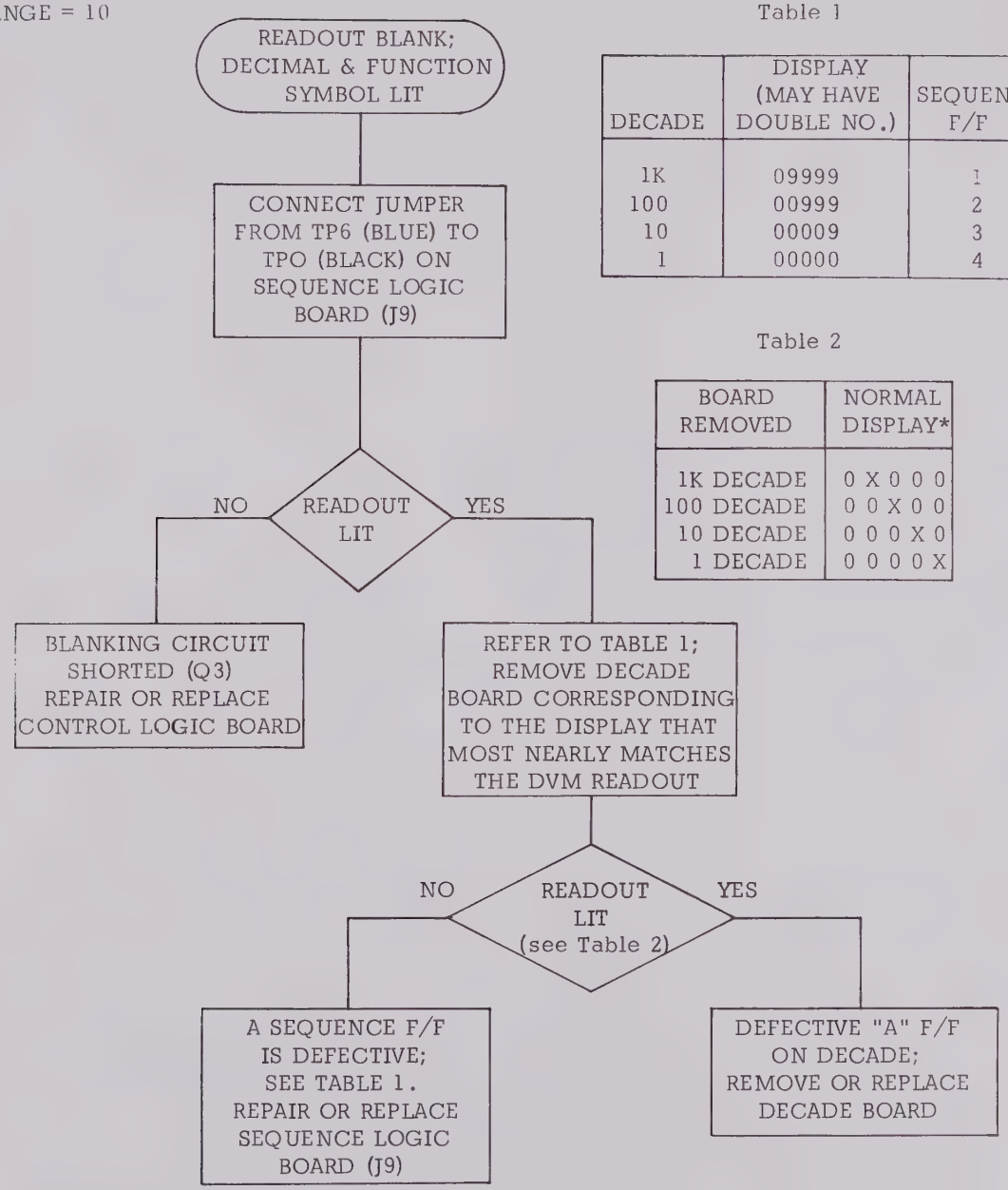



Table 1

| DECADE | DISPLAY (MAY HAVE DOUBLE NO.) | SEQUENCE F/F |
|---|---|---|
| 1K | 09999 | 1 |
| 100 | 00999 | 2 |
| 10 | 00009 | 3 |
| 1 | 00000 | 4 |

Table 2

| BOARD REMOVED | NORMAL DISPLAY* |
|---|---|
| 1K DECADE | 0 X 0 0 0 |
| 100 DECADE | 0 0 X 0 0 |
| 10 DECADE | 0 0 0 X 0 |
| 1 DECADE | 0 0 0 0 X |

Figure 5.4. Display Blank, Decimal and Function Indicator Lit

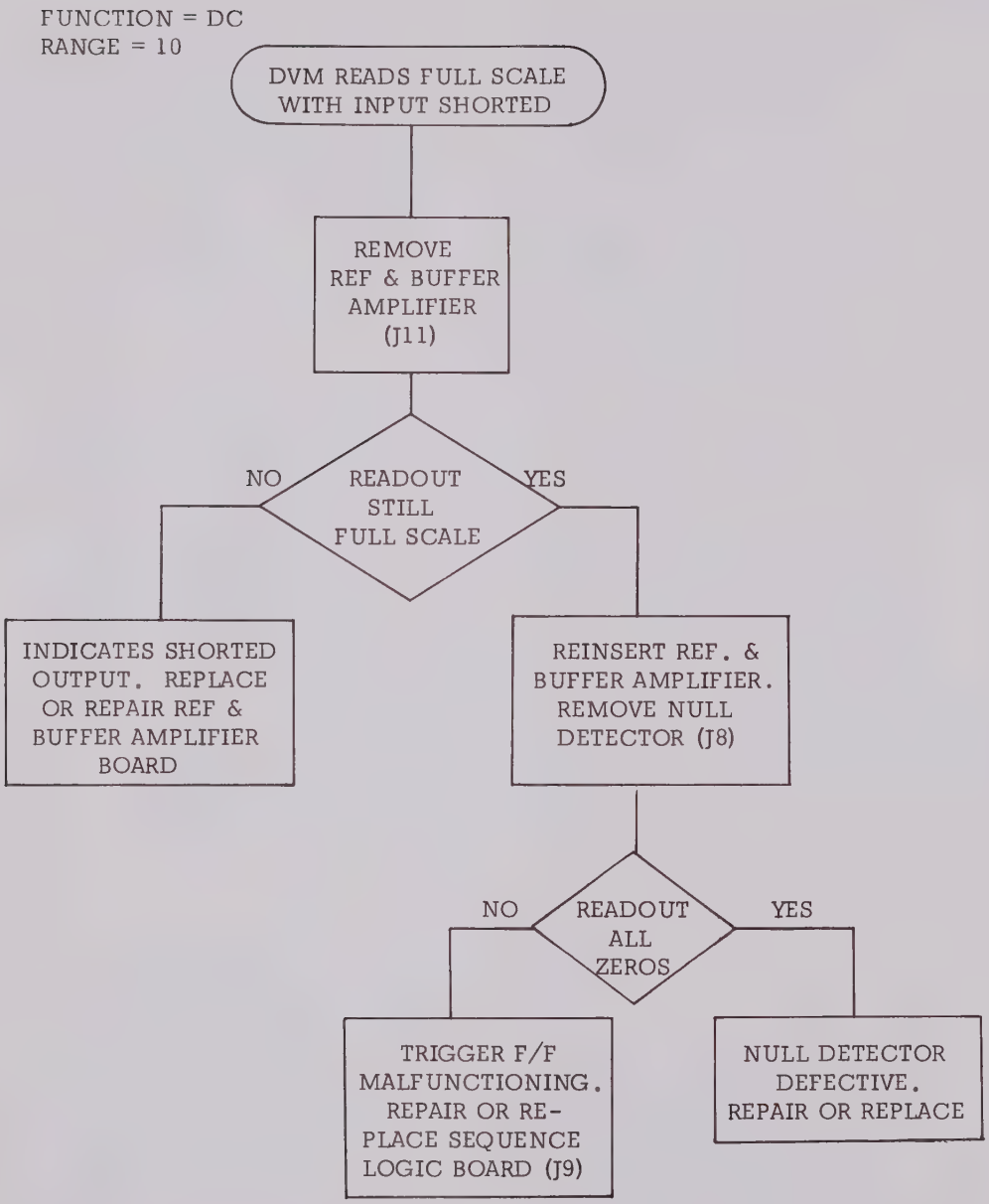
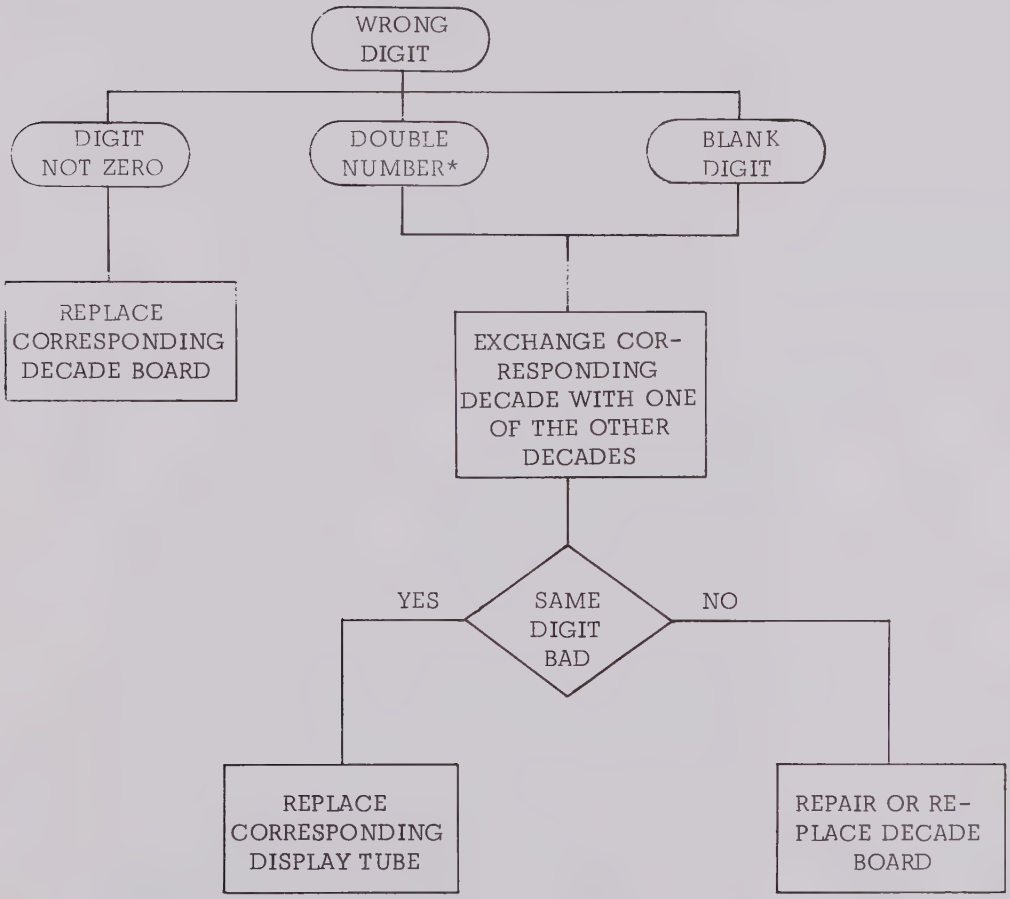



Figure 5.5. Full Scale With Input Shorted




*On certain input voltages

Figure 5.6. Wrong Digit

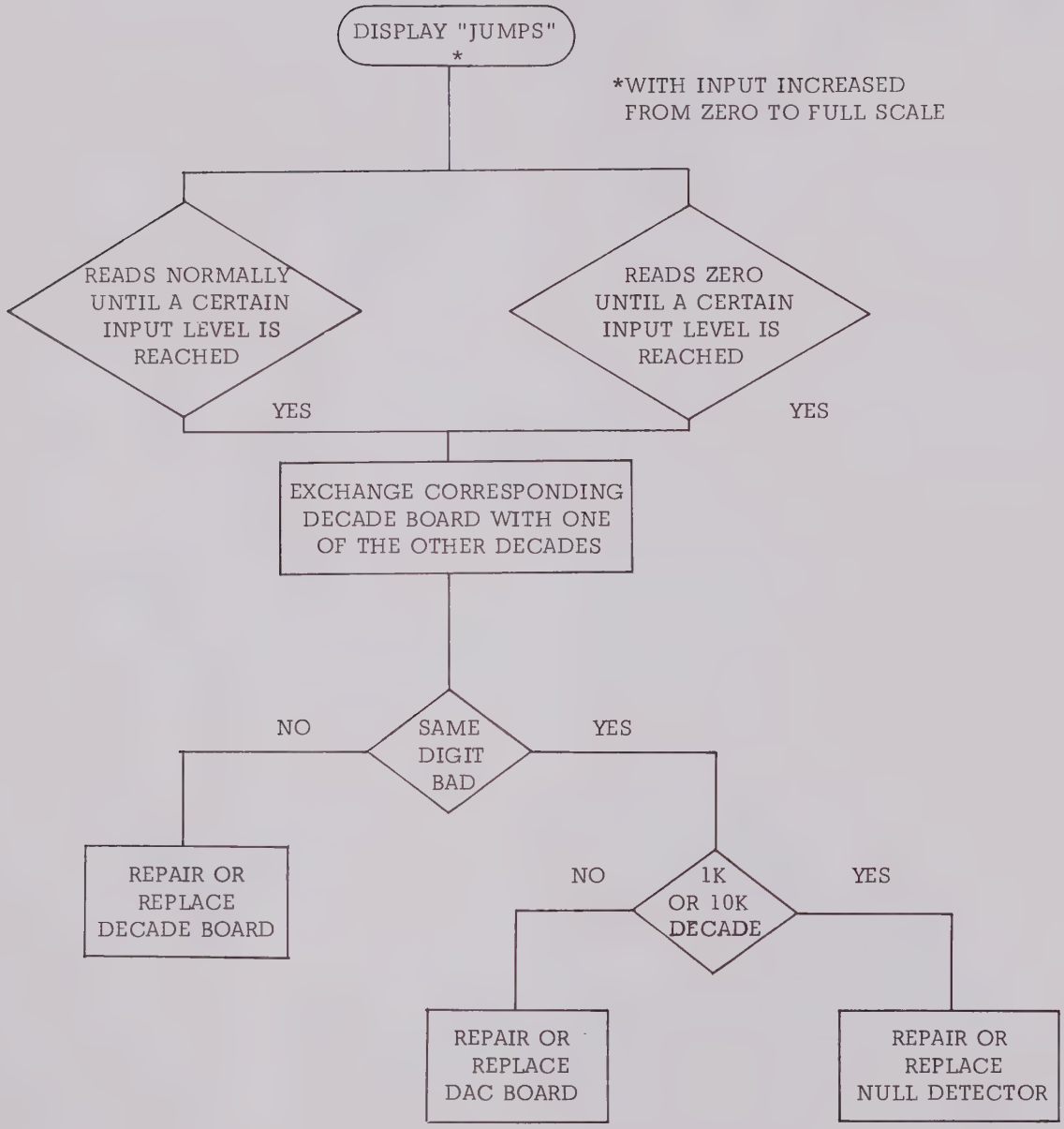



Figure 5.7. Display Jumps

# SECTION 6
# DRAWINGS AND PARTS LISTS

## 6.1 DRAWINGS

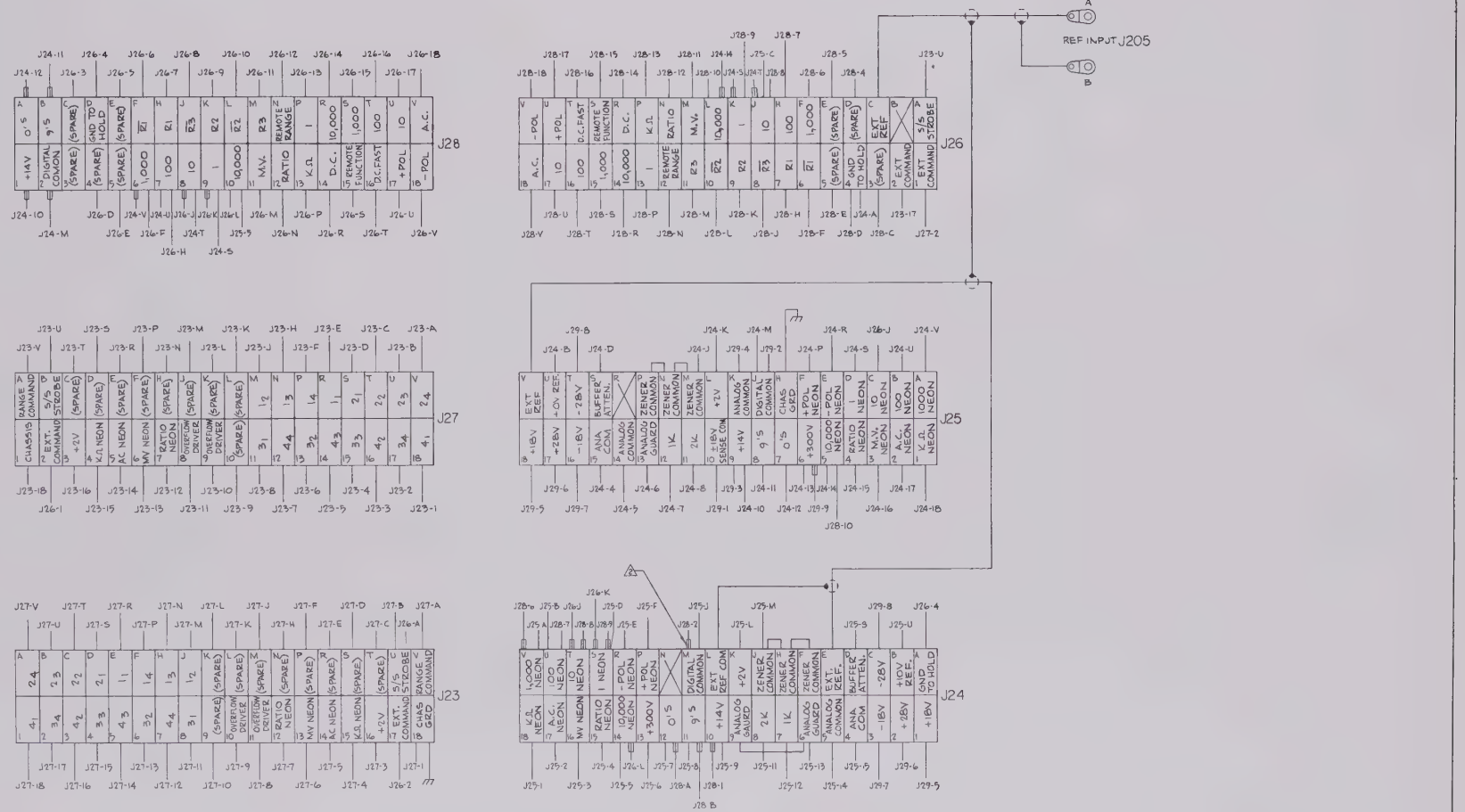
The following drawings are included in this section:

| | |
|---|---|
| Wiring Diagram - Interconnection 5400 | 430311 |
| Wiring Diagram - Interconnection 5400 | 430687 |
| Wiring Diagram - Intraconnection - 020 | 430418 |
| Wiring Diagram - Intraconnection - 030, 031 | 430419 |
| Assembly - Control and Attenuator - 020 | 400858 |
| Schematic - Control and Attenuator - 020 | 430464 |
| Assembly - Control and Attenuator - 030 | 400698 |
| Schematic - Control and Attenuator - 030 (2 sheets) | 430310 |
| Assembly - Control & Attenuator - 031 | 402384 |
| Assembly - Control & Attenuator - 031 | 402966* |
| Schematic - Control & Attenuator - 031 (2 sheets) | 430610 |
| Schematic - Control & Attenuator | 430721* |
| PC Board Assembly - Switch Panel - 020 | 402158 |
| PC Board Assembly - Switch Panel - 030 | 400704 |
| PC Board Assembly - Switch Panel - 031 | 402967 |
| PC Board Assembly - Auto Polarity | 402056 |
| Schematic - Auto Polarity | 430415 |
| PC Board Assembly - Auto Polarity | 402661* |
| Schematic - Auto Polarity | 430756 |
| PC Board Assembly - Range Control - 020, 030 | 402197 |
| Schematic - Range Control - 020, 030 | 430501 |
| PC Board Assembly - Range Control - 031 | 402382 |
| Schematic - Range Control - 031 | 430608 |
| PC Board Assembly - Range Control | 402695 |
| Schematic - Range Control | 430760 |
| PC Board Assembly - Ohms Converter | 400705 |
| Schematic - Ohms Converter | 430303 |
| PC Board Assembly - AC Converter - 020, 030 | 400706 |
| Schematic - AC Converter - 020-030 | 430306 |
| PC Board Assembly - AC Converter - 031 | 402383 |
| Schematic - AC Converter - 031 | 430609 |
| PC Board Assembly - Isolator | 400700 |
| PC Board Assembly - Isolator | 402796* |
| Schematic - Isolator | 430305 |
| PC Board Assembly - Isolator | 402983* |
| Schematic - Isolator | 430816* |
| Rear Input Plug Assembly - Four Wire | 402009 |
| Rear Input Plug Assembly - Two Wire | 402010 |

*Used on later production runs

## 6.2 PARTS LISTS

Parts Lists follow the drawings in the same sequence in which the drawings are listed.




⚠ LEADS INDICATED THUS: CONSIST PARTIALLY OF 22 GA. TINNED BUS WIRE (P/N 500004) INSULATED WITH 20 GA. TEFLON SLEEVING (P/N 501376).

1. CONNECTORS SHOWN AS VIEWED FROM REAR OF INSTRUMENT; PINS J23, J24, J25 AND J26 ARE ON FAR SIDE OF INTERCONNECTION BOARD, J27, J28 AND J29 ARE ON NEAR SIDE

NOTES UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|
| | | | | | LIST OF MATERIAL OR PARTS LIST | | |

| | | | |
|---|---|---|---|
| 400683 | 3400 | REF | R |
| NEXT DWG | USED ON | REF DWG NEXT ASSY | REF DWG THIS ASSY |
| APPLICATION | | QTY REQD | |

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: .X ± .030, .XX ± .020, .XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1 0°
ECCENTRIC IN BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL D-1000 AND MIL D-70327

CONTRACT NO.

| NAME | DATE |
|---|---|
| DR W.EDIE | 10-28-65 |
| CHK T.OFT | 11-10-65 |
| APPD J.NELSON | 11-10-65 |

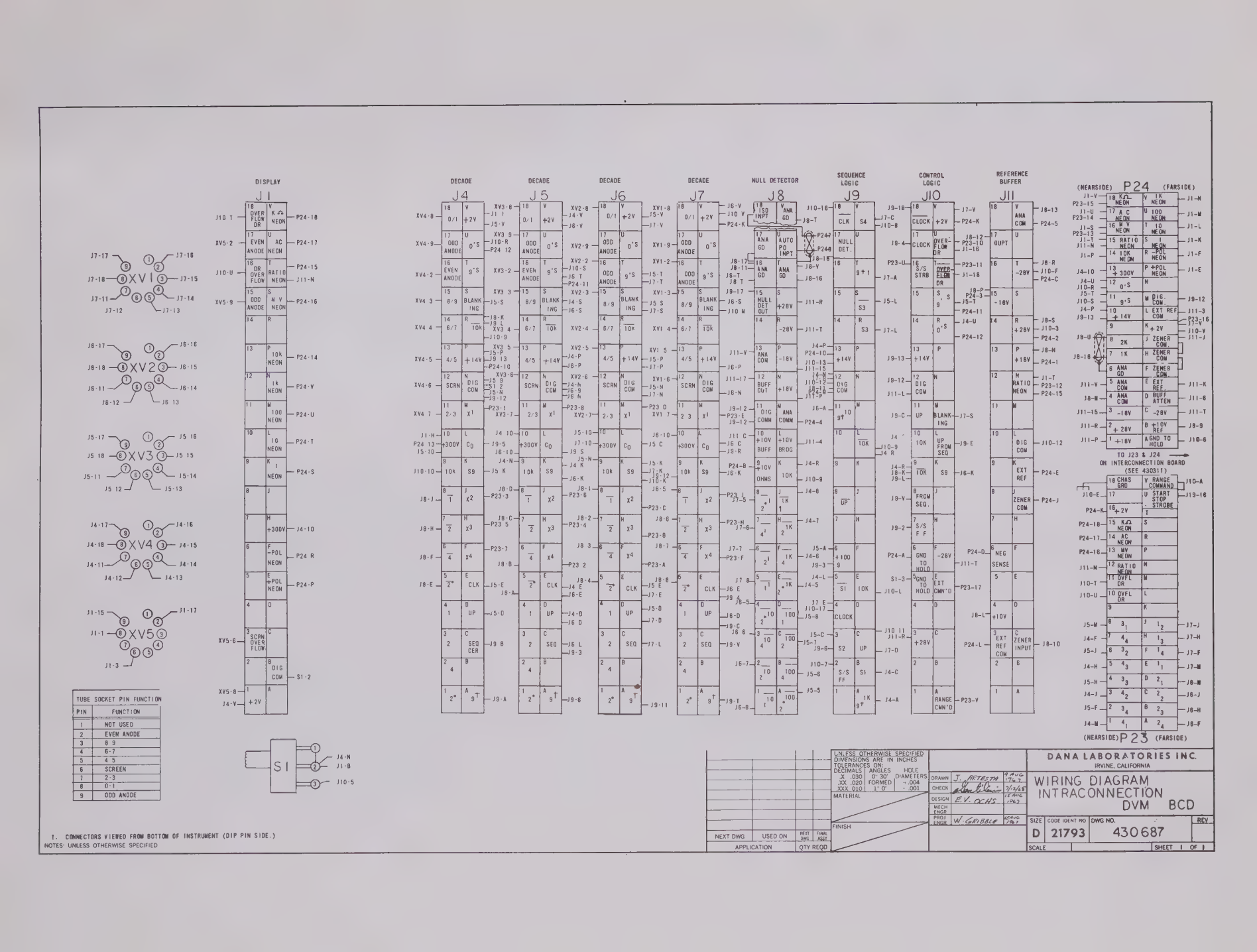
REL 11-17-65
DRN 538 SAM

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

WIRING DIAGRAM
INTERCONNECTION

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| E | 21793 | 430311 | K |

SCALE NONE WT SHEET 1 OF 1




| TUBE SOCKET PIN FUNCTION | |
|---|---|
| PIN | FUNCTION |
| 1 | NOT USED |
| 2 | EVEN ANODE |
| 3 | 8 9 |
| 4 | 6-7 |
| 5 | 4 5 |
| 6 | SCREEN |
| 7 | 2-3 |
| 8 | 0-1 |
| 9 | ODD ANODE |

1. CONNECTORS VIEWED FROM BOTTOM OF INSTRUMENT (DIP PIN SIDE.)

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON: DECIMALS X .030 XX .020 XXX .010; ANGLES 0° 30' FORMED 1° 0'; HOLE DIAMETERS +.004 -.001
MATERIAL
FINISH

| | | | |
|---|---|---|---|
| DRAWN | J. ARTESTA | 9 AUG 1962 | |
| CHECK | | 2/4/65 | |
| DESIGN | E.V. OCHS | 12 AUG 1963 | |
| MECH ENGR | | | |
| PROJ ENGR | W. GRIBBLE | 12 AUG 1963 | |

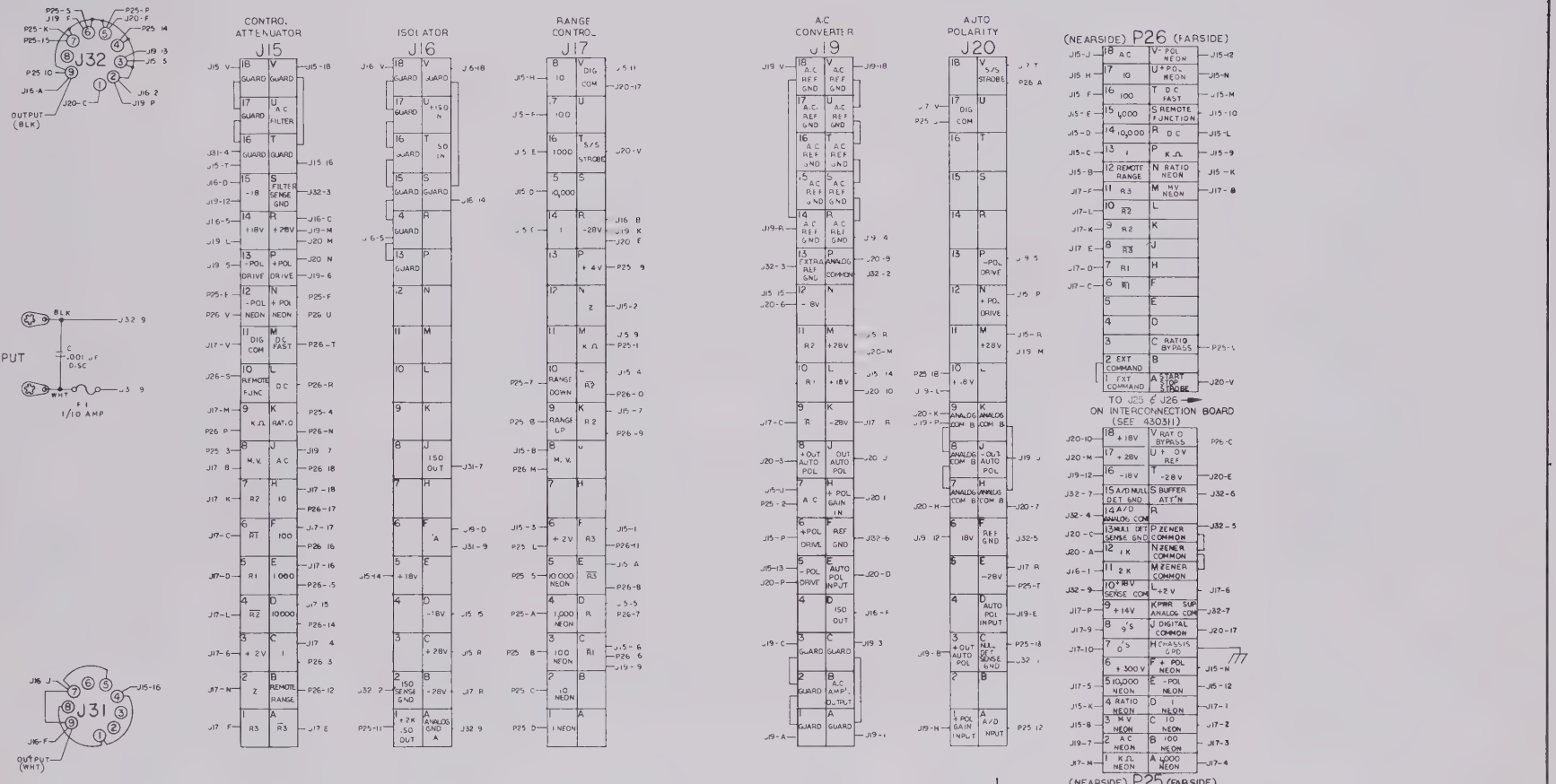
| NEXT DWG | USED ON | NEXT DWG | FINAL ASSY |
|---|---|---|---|
| APPLICATION | | QTY REQD | |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# WIRING DIAGRAM INTRACONNECTION DVM BCD

| SIZE | CODE IDENT NO | DWG NO. | REV |
|---|---|---|---|
| D | 21793 | 430687 | |

SCALE | SHEET 1 OF 1




NOTES: UNLESS OTHERWISE SPECIFIED

1. CONNECTOR VIEWED FROM WIRING (DIP PIN) SIDE

LIST OF MATERIAL OR PARTS LIST

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ±.030, XX ±.020, XXX ±.010
ANGLES ±0° 30'
FORMED ANGLES ±1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

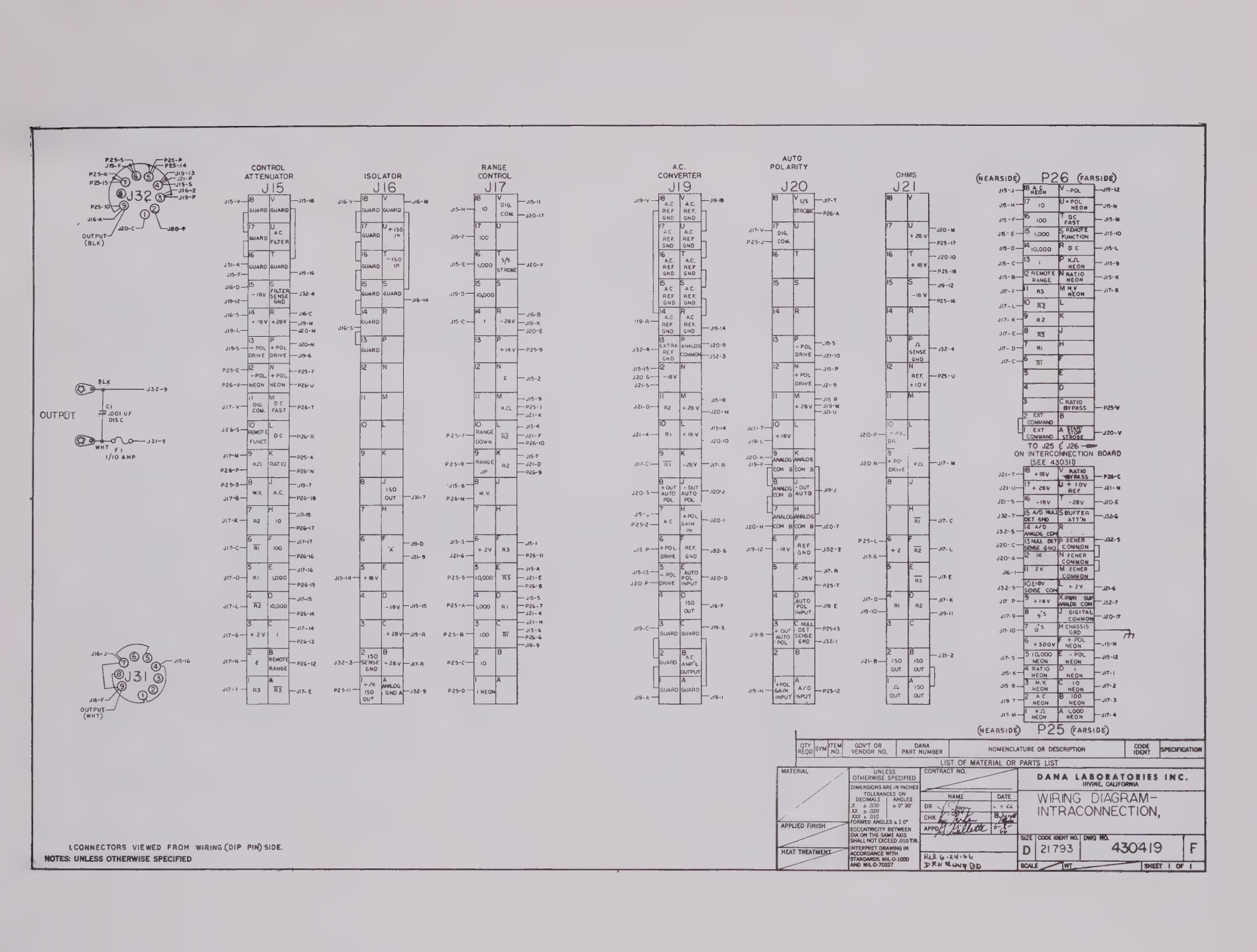
| | NAME | DATE |
|---|---|---|
| DR | | 6 4 66 |
| CHK | | 6-7-66 |
| APPD | | 6-8-66 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

WIRING DIAGRAM — INTRACONNECTION, 020

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 430418 | E |

SCALE — WT — SHEET 1 OF 1




| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ± .030, XX ± .020, XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | | 6 Y 66 |
| CHK | | 8-66 |
| APPD | | 6-24-66 |

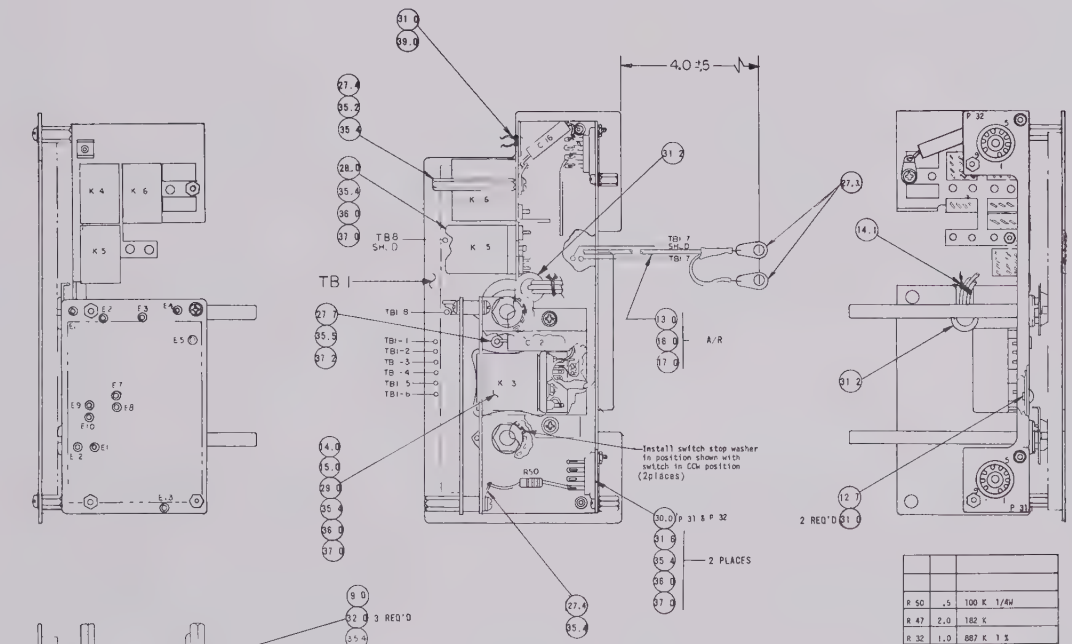
REL 6.24.66
DRN 6 JUN 66

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# WIRING DIAGRAM-INTRACONNECTION,

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 430419 | F |

SCALE | WT | SHEET 1 OF 1




| FROM | TO | CONDUCTOR USED; COLOR | B/M ITEM NO. | WIRE LENGTH | NOTES |
|---|---|---|---|---|---|
| P32-1 | P32-2 | BUSS WIRE | 14.0 | | |
| P32-2 | P32-3 | BUSS WIRE | 14.0 | | |
| P32-3 | LUG | C18, .22UF/100V | 3.5 & 15.0 | | LEADS SLEEVED A/R |
| P32-3 | P32-4 | BUSS WIRE | 14.0 | | |
| P32-4 | P32-5 | BUSS WIRE | 14.0 | | |
| P32-5 | P32-8 | BUSS WIRE | 14.0 | | |
| P32-8 | P32-7 | BUSS WIRE | 14.0 | | |
| P32-7 | P32-9 | SLEEVED BUSS WIRE | 14.0 & 15.0 | | |
| TB1-2 | K4-4 | 9-2 | 23.0 | | Via Grommet (Item 31.2) |
| TB1-3 | K3-1 | 9-3 | 24.0 | | |
| TB1-4 | K5-4 | 9-1-5 | 20.7 | | |
| TB1-5 | K6-1 | 9 | 19.5 | | |
| TB1-6 | K6-4 | 9-1-6 | 21.0 | | |
| TB1-7 | K3-16 | RG174/U | 16.0 | | |
| Shld to TB1-7 Shld | Shld not conn. | 0 | 17.0 and 13.0 | | Tubing as Req'd |
| TB1-8 | K6-9 | RG174/U | 16.0 | | |
| Shld to TB1-8 Shld | Shld not conn. | 0 | 17.0 and 13.0 | | Via Grommet (Item 31.2) Tubing as Req'd |
| E-1 | K5-10 | 8 | 20.5 | | |
| E-11 | K5-5 | 9-1 | 21.9 | | |
| E-12 | K5-7 | 0 | 17.0 | | |
| E-3 | K6-16 | 2-1-1 | 16.5 | | |
| E-4 | K5-8 | 9-1-3 | 20.5 | | |
| E-8 | K4-13 | 9-1-4 | 21.5 | | |
| E-7 | K6-16 | 2-1-4 | 16.5 | | |
| E-5 | K4-11 | 9-1-7 | 21.3 | | |
| E-6 | P31-5 | 9-1-5 | 19.0 | | |
| E-2 | P32-1 | 9-1-5 | 19.0 | | |
| E-10 | P31-7 | 7-2-8 | 20.0 | | |
| K3-4 | K4- | 9-1 | 21.9 | | |
| K3-14 | K4-15 | Sleeved Buss Wire | 14.0 &15.0 | | |
| K3-11 | K4- 9 | Sleeved Buss Wire | 14.0 &15.0 | | |
| K3-8 | K4-12 | Sleeved Buss Wire | 14.0 &15.0 | | |
| K3-13 | K5-1 | RG174/U | 16.0 | | |
| Shld not conn. | Shld to P31-1 | 0 | 17.0 and 13.0 | | Tubing as Req'd |
| K3-10 | P32-8 | C12, .22UF/600V | 3.0 &15.0 | | Leads Sleeved as Req'd |
| K3-15 | K6-15 | RG174/U | 16.0 | | |
| Shld not conn. | Shld to P31-4 | 0 | 17.0 and 13.0 | | Tubing as Req'd |
| K3-16 | P31-3 | RG174/U | 16.0 | | |
| Shld not conn. | Shld to P31-4 | 0 | 17.0 and 13.0 | | Tubing as Req'd |
| K3-9 | Shld to Lug(Item no. 27.3) | RG174/U | 16.0 | | |
| Shld to P32-9 | Shld to Lug(Item no. 27.3) | 0 | 17.0 and 13.0 | | Tubing as Req'd |
| K4-1 | K6-4 | 9-2-4 | 22.0 | | |
| K4-14 | K6-10 | R47, 182 K C15, .0047UF/100V | 2.0, 4.0 and 15.0 | | Resistor wired in parallel with capacitor; Leads sleeved as req'd. |
| K4-[illegible] | K6-7 | R32, 887K ,1% | 3.0 &15.0 | | Leads Sleeved as Req'd |
| K4-8 | P31-2 | 0-9 | 17.5 | | |
| K4-10 | K5-6 | 9 | 25.0 | | |
| K5-9 | K6-8 | RG174/U | 16.0 | | |
| Shld to P31-4 | Shld not conn. | 0 | 17.0 and 13.0 | | Tubing as Req'd |
| K5-1 | K6-4 | 0 | 17.0 | | |
| K6-12 | P31-2 | RG174/U | 16.0 | | |
| Shld not conn. | Shld to P31-1 | 0 | 17.0 and 13.0 | | Tubing as Req'd |
| K6-15 | P32-5 | 9 | 25.0 | | |
| K6-5 | K6-11 | Sleeved Buss Wire | 14.0 &15.0 | | |
| K6-6 | K6-10 | Sleeved Buss Wire | 14.0 &15.0 | | |
| P31-1 | Lug(Item no. 27.4) | R50, 100K, 1/4W | .5 & 15.0 | | Leads Sleeved as Req'd |

| | | |
|---|---|---|
| | | |
| | | |
| R 50 | .5 | 100 K 1/4W |
| R 47 | 2.0 | 182 K |
| R 32 | 1.0 | 887 K 1 % |
| K 6 | 7.5 | 4PDT 310030 |
| K 5 | 7.4 | DPDT 310021 |
| K 4 | 7.5 | 4PDT 310030 |
| K 3 | 7.5 | 4PDT 310030 |
| C 16 | 3.5 | .015 MFD 100V |
| C 15 | 4.0 | .0047 MFD 100V |
| C 12 | 3.0 | .22 MFD 600V |
| REF DES | B/M ITEM | DESCRIPTION |

| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO | PART NO |
| 8 0 | 400882 |
| 9.0 | 402158 |
| 12.0 | 450854 |
| 12.7 | 452039 |
| 12.8 | 452040 |
| 13 0 | 500002 |
| 14 0 | 500004 |
| 14 1 | 500005 |
| 15 0 | 521378 |
| 16 0 | 501446 |
| 17 0 | 524000 |
| 17.5 | 524090 |
| 18 0 | 524208 |
| 18 5 | 524211 |
| 18 0 | 524215 |
| 19 5 | 524555 |
| 20 0 | 524728 |
| 20.5 | 524888 |
| 20.8 | 524913 |
| 20 7 | 524915 |
| 21 0 | 524916 |
| 21.3 | 524917 |
| 21 8 | 524918 |
| 21 9 | 524919 |

| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO | PART NO |
| 22 0 | 524924 |
| 23.0 | 524929 |
| 24.0 | 524939 |
| 25 0 | 524959 |
| 27 3 | 600026 |
| 27.4 | 600032 |
| 27.7 | 600129 |
| 28.0 | 600221 |
| 29 0 | 600222 |
| 30.0 | 600232 |
| 31 0 | 610019 |
| 31 2 | 610027 |
| 31.4 | 610111 |
| 31.8 | 610118 |
| 32.0 | 610240 |
| 33 0 | 810251 |
| 34 0 | 610256 |
| 35 0 | 810257 |
| 35 2 | 610263 |
| 35 4 | 615042 |
| 35.5 | 615056 |
| 36 0 | 617018 |
| 37 0 | 617077 |
| 37 2 | 617079 |
| 39 0 | 920113 |

RELAY TERMINAL LAYOUTS

NOTES: UNLESS OTHERWISE SPECIFIED

1. SCHEMATIC REFERENCE: 430464
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM TO DANA WORKMANSHIP STANDARDS.
3. WIRING DIAGRAM REFERENCE 430484

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS ± ANGLES ± 0° 30'
X ±.030
XX ±.020
.XXX ±.010
FORMED ANGLES ±1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

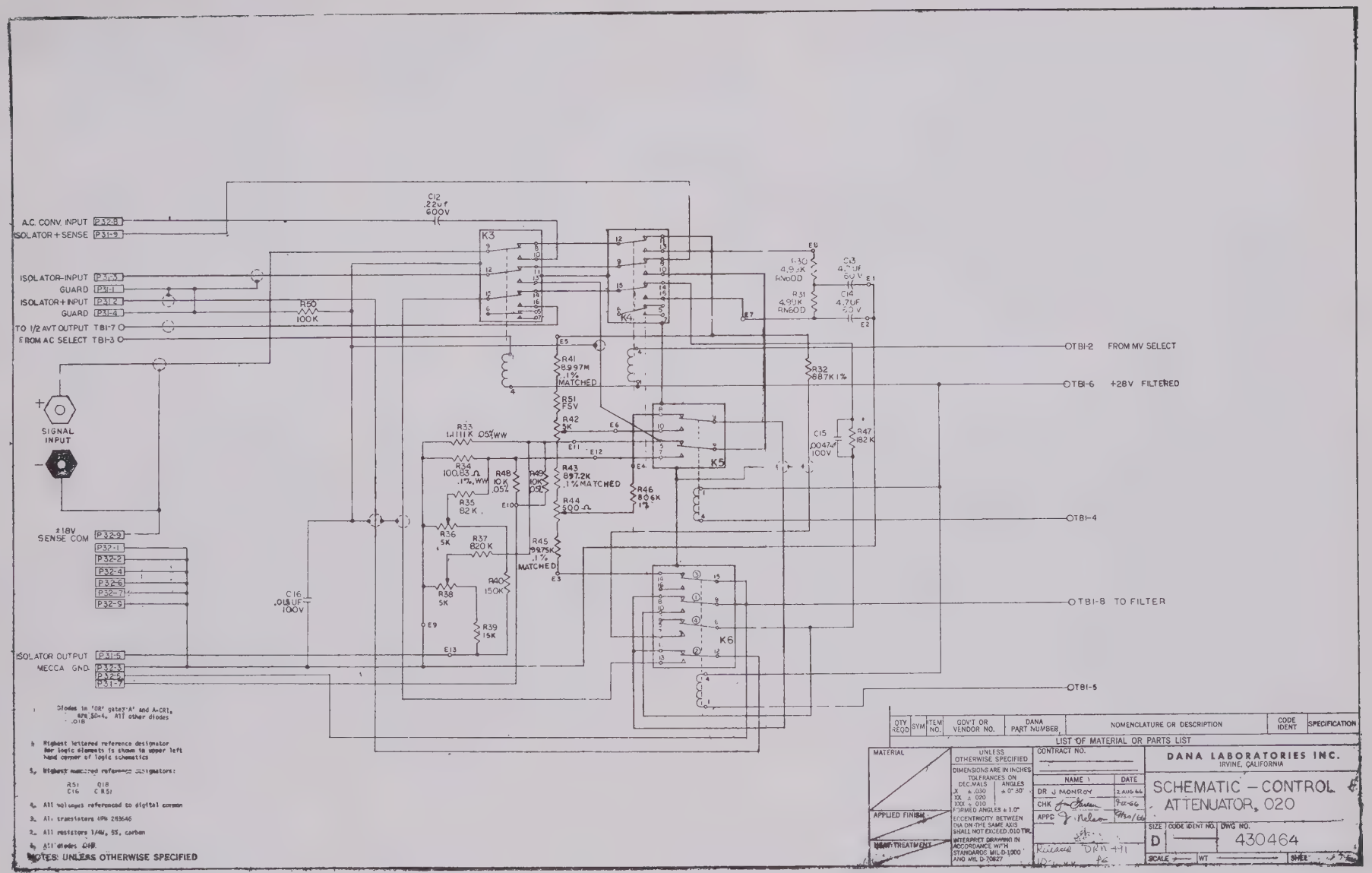
| | NAME | DATE |
|---|---|---|
| DR | [illegible] | 11 MAR 1966 |
| CHK | [illegible] | 24 Mar 66 |
| APPD | [illegible] | 4/24/66 |

Rel. 6-30-66
DRN# 45782B

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# ATTENUATOR & CONTROL ASSY - 020

SIZE D | CODE IDENT NO. | DWG NO. 400858 | L
SCALE 1/1 | WT | SHEET 1 OF 1




1. Diodes in 'OR' gate 'A' and A-CR1, 879,3Dm4. All other diodes 1N918.
2. Highest lettered reference designator for logic elements is shown in upper left hand corner of logic schematics
3. Highest numbered reference designators:
   R51 Q18
   C16 CR51
4. All voltages referenced to digital common
5. All transistors HPA 2N3646
6. All resistors 1/4W, 5%, carbon
7. All diodes 1N914

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ± .030, XX ± .020, XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL D-70827

CONTRACT NO.

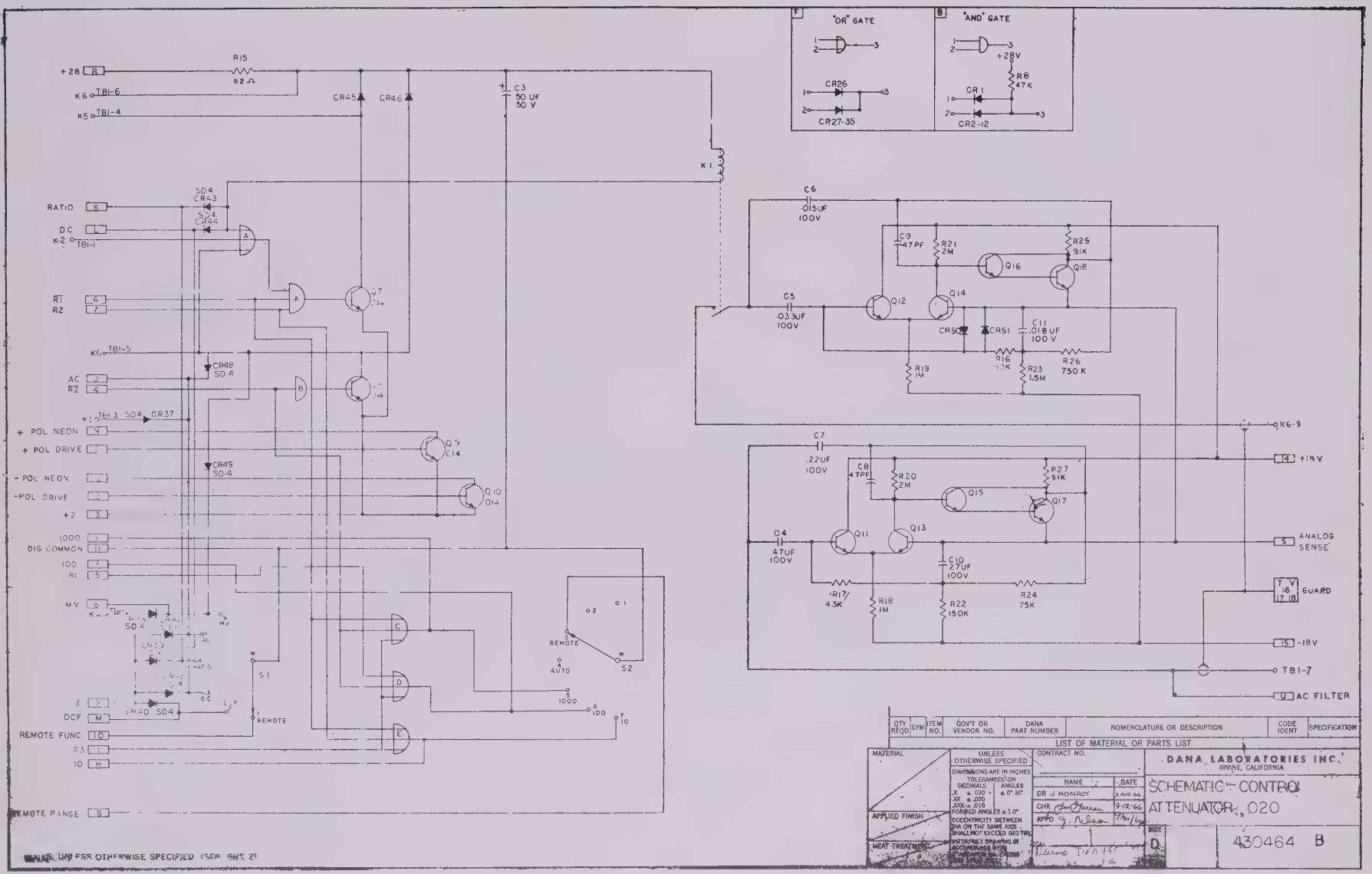
| NAME | DATE |
|---|---|
| DR J MONROY | 2 AUG 66 |
| CHK | 8-2-66 |
| APPD | 8/2/66 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# SCHEMATIC – CONTROL ATTENUATOR, 020

| SIZE | CODE IDENT NO. | DWG NO. |
|---|---|---|
| D | | 430464 |

SCALE | WT | SHEET




| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREAT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS .X ± .030, .XX ± .020, .XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR
INTERPRET DRAWING IN ACCORDANCE WITH

CONTRACT NO.

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

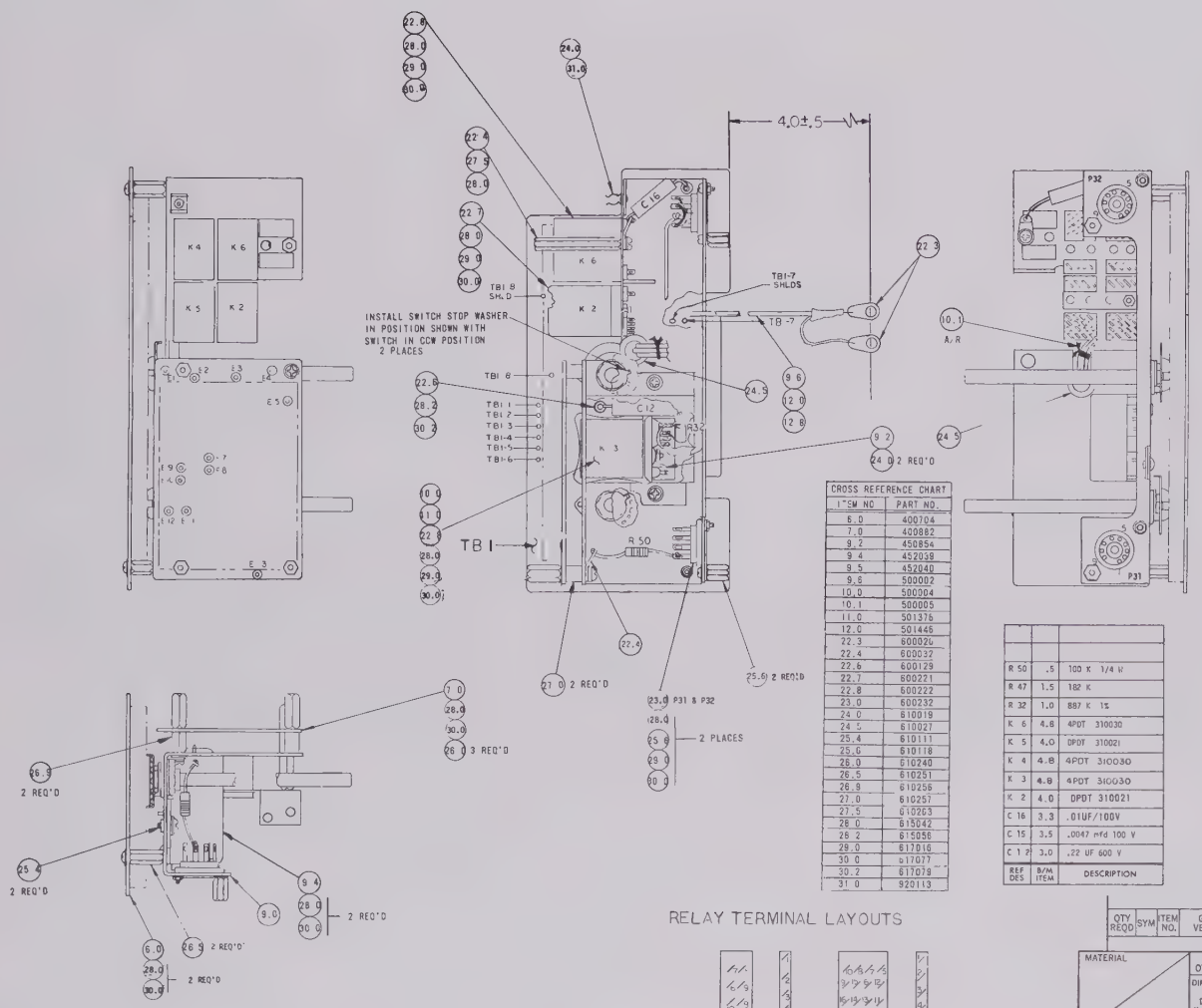
| | NAME | DATE |
|---|---|---|
| DR | J MONROY | 2 AUG 66 |
| CHK | | 9-12-66 |
| APPD | | 9/30/66 |

SCHEMATIC — CONTROL ATTENUATOR .020

SIZE D

430464 B

UNLESS OTHERWISE SPECIFIED REF SNT 2




| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO | PART NO. |
| 6.0 | 400704 |
| 7.0 | 400882 |
| 9.2 | 450854 |
| 9.4 | 452038 |
| 9.5 | 452040 |
| 9.6 | 500002 |
| 10.0 | 500004 |
| 10.1 | 500005 |
| 11.0 | 501376 |
| 12.0 | 501448 |
| 22.3 | 600026 |
| 22.4 | 600032 |
| 22.6 | 600129 |
| 22.7 | 600221 |
| 22.8 | 600222 |
| 23.0 | 600232 |
| 24.0 | 610019 |
| 24.5 | 610027 |
| 25.4 | 610111 |
| 25.6 | 610118 |
| 26.0 | 610240 |
| 26.5 | 610251 |
| 26.8 | 610256 |
| 27.0 | 610257 |
| 27.5 | 610263 |
| 28.0 | 615042 |
| 28.2 | 615056 |
| 29.0 | 617016 |
| 30.0 | 617017 |
| 30.2 | 617078 |
| 31.0 | 920113 |

| | | | |
|---|---|---|---|
| R 50 | .5 | 100 K 1/4 W | |
| R 47 | 1.5 | 182 K | |
| R 32 | 1.0 | 887 K 1% | |
| K 6 | 4.8 | 4PDT 310030 | |
| K 5 | 4.0 | DPDT 310021 | |
| K 4 | 4.8 | 4PDT 310030 | |
| K 3 | 4.8 | 4PDT 310030 | |
| K 2 | 4.0 | DPDT 310021 | |
| C 16 | 3.3 | .01UF/100V | |
| C 15 | 3.5 | .0047 mfd 100 V | |
| C 17 | 3.0 | .22 UF 600 V | |
| REF DES | B/M ITEM | DESCRIPTION | |

| FROM | TO | CONDUCTOR USED; COLOR | B/M ITEM NO. | WIRE LENGTH | NOTES |
|---|---|---|---|---|---|
| P32-2 | P32-3 | BUSS WIRE | 10.0 | | |
| P32-3 | LUG | C18, .01SUF/100V | 3.3 & 11.0 | | LEADS SLEEVED A/R |
| P32-3 | P32-4 | BUSS WIRE | 10.0 | | |
| P32-4 | P32-5 | BUSS WIRE | 10.0 | | |
| P32-5 | P32-6 | BUSS WIRE | 10.0 | | |
| P32-6 | P32-7 | BUSS WIRE | 10.0 | | |
| P32-7 | P32-9 | SLEEVED BUSS WIRE | 10.0 & 11.0 | | |
| TB1-1 | K2-4 | 9-1-2 | 16.0 | | VIA GROMMET (ITEM 24.5) |
| TB1-2 | K4-4 | 9-2 | 20.0 | | |
| TB1-3 | K3-1 | 9-3 | 20.5 | | |
| TB1-4 | K5-4 | 9-1-5 | 17.0 | | |
| TB1-5 | K6-1 | 5 | 14.5 | | |
| TB1-6 | K6-4 | 9-1-6 | 17.5 | | |
| TB1-7 | K5-15 | RG174/U | 12.0 | | |
| Shld to TB1-7 Shld | Shld not conn. | 0 | 12.8 & 9.6 | | TUBING AS REQ'D |
| TB1-8 | K6-9 | RG174/U | 12.0 | | |
| Shld to TB1-8 Shld | Shld not conn. | 0 | 12.8 & 9.6 | | VIA GROMMET (ITEM 24.5) TUBING AS REQUIRED |
| K5-10 | K5-10 | 8 | 15.5 | | |
| K5-1 | K5-5 | 9-1 | 19.0 | | |
| K5-2 | K5-7 | 7 | 12.8 | | |
| K5-3 | K5-14 | 9-1-1 | 13.5 | | |
| K5-4 | K5-8 | 9-1-3 | 16.5 | | |
| K5-9 | K6-1 | 9-1-6 | 13.0 | | |
| K5-7 | K4-4 | 9-2-6 | 18.5 | | |
| K5-6 | K4-11 | 9-1-7 | 18.0 | | |
| K5-13 | P31-5 | 9-1-5 | 14.0 | | |
| K5-11 | K2-8 | 9-1-5 | 14.0 | | |
| K5-12 | P31-7 | 7-2-8 | 15.0 | | |
| K2 | K3-4 | 9-1-3 | 16.5 | | VIA GROMMET ITEM 24.5 |
| K2-5 | P32-3 | 9-1-2 | 16.0 | | |
| K2-6 | Lug(Item no. 22.3) | RG174/U | 12.0 | | |
| K2-8 | Shld to Shld | 0 | 12.8 & 9.6 | | TUBING AS REQ'D |
| K2-7 | P31-6 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-7 | 0 | 12.8 & 9.6 | | TUBING AS REQ'D |
| K2-9 | P32-1 | 9-1-5 | 17.0 | | VIA GROMMET ITEM 24.5 |
| K3-4 | K4-1 | 9-1 | 19.0 | | |
| K3-14 | K4-15 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K3-11 | K4-9 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K3-9 | K4-12 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K3-13 | K5-5 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-1 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K3-10 | P32-8 | C12, .22UF/ 600V | 3.0 & 11.0 | | Leads Sleeved As Req'd |
| K3-15 | K6-13 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-4 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K3-12 | P31-3 | RG174/U | 12.0 | | |
| Shld not conn | Shld to P31-4 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K3-9 | Lug(Item no. 22.3) | RG174/U | 12.0 | | |
| Shld to R32-9 | Shld to Lug Item no. 22.3) | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K4-1 | K6-1 | 9-2-4 | 19.5 | | |
| K4-14 | K6-10 | P47, 182K (15), .0047UF/100V | 1.5 & 3.5 & 11.0 | | Resistor wired in parallel with capacitor; Leads sleeved as req'd. |
| K4-11 | K6-7 | R32, 887K .1% | 1.0 & 11.0 | | Leads Sleeved As Req'd |
| K4-9 | P31-9 | 0-9 | 12.0 | | |
| K4-10 | K5-6 | 9 | 22.1 | | |
| K5-9 | K6-8 | RG174/U | 12.0 | | |
| Shld to P31-4 | Shld not conn. | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K5-1 | K6-4 | 0 | 12.8 | | |
| K5-12 | P31-2 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-1 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K6-15 | P32-5 | 9 | 22.1 | | |
| K6-8 | K6-11 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K6-6 | K6-10 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| P31-1 | Lug(Item no. 22.4) | R50, 100K, 1/4 W | .5 & 11.0 | | Leads Sleeved As Req'd |

RELAY TERMINAL LAYOUTS



K2, K5 K3, K4, K6

3. SCHEMATIC REFERENCE: 430310
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.
1. WIRING DIAGRAM REFERENCE 430310

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS X ±.030 XX ±.020 XXX ±.010 ANGLES ±0° 30'
FORMED ANGLES ±1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

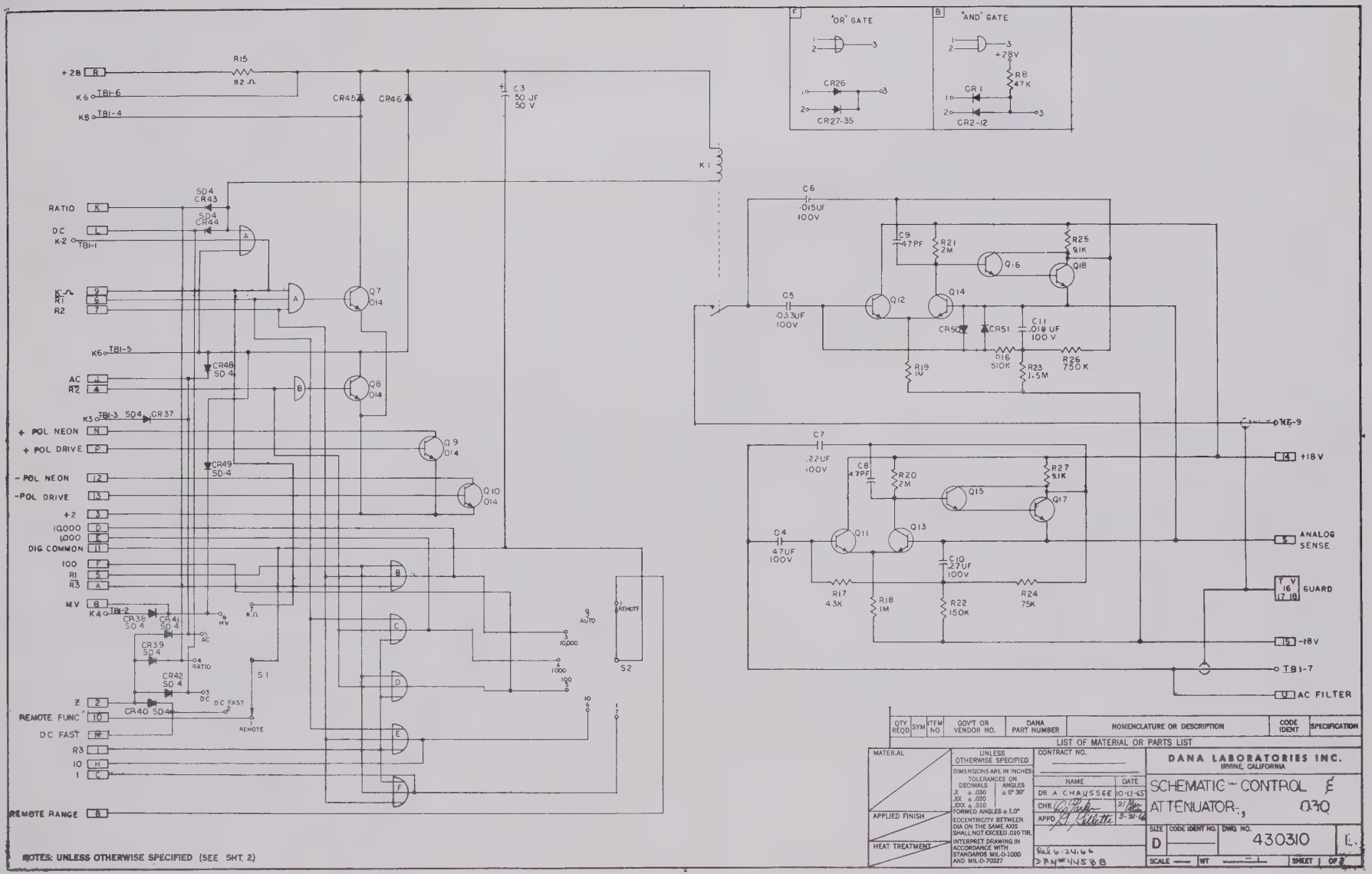
CONTRACT NO.

| NAME | DATE |
|---|---|
| DR W. Eche | Nov 1965 |
| CHK T Toft | 2 APR 1966 |
| APPD. [illegible] | 4/6 |
| [illegible] | 6.21.66 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# ATTENUATOR & CONTROL ASS'Y - MULTIMETER (030)

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | —— | 400698 | N |
| SCALE 1/1 | WT —— | SHEET 1 OF 1 | |




NOTES: UNLESS OTHERWISE SPECIFIED (SEE SHT 2)

| QTY REQD | SYM | ITEM NO | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: .XX ± .030, .XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

| NAME | DATE |
|---|---|
| DR A CHAUSSEE | 10-13-65 |
| CHK | 2/ Mar |
| APPD | 8-24-66 |

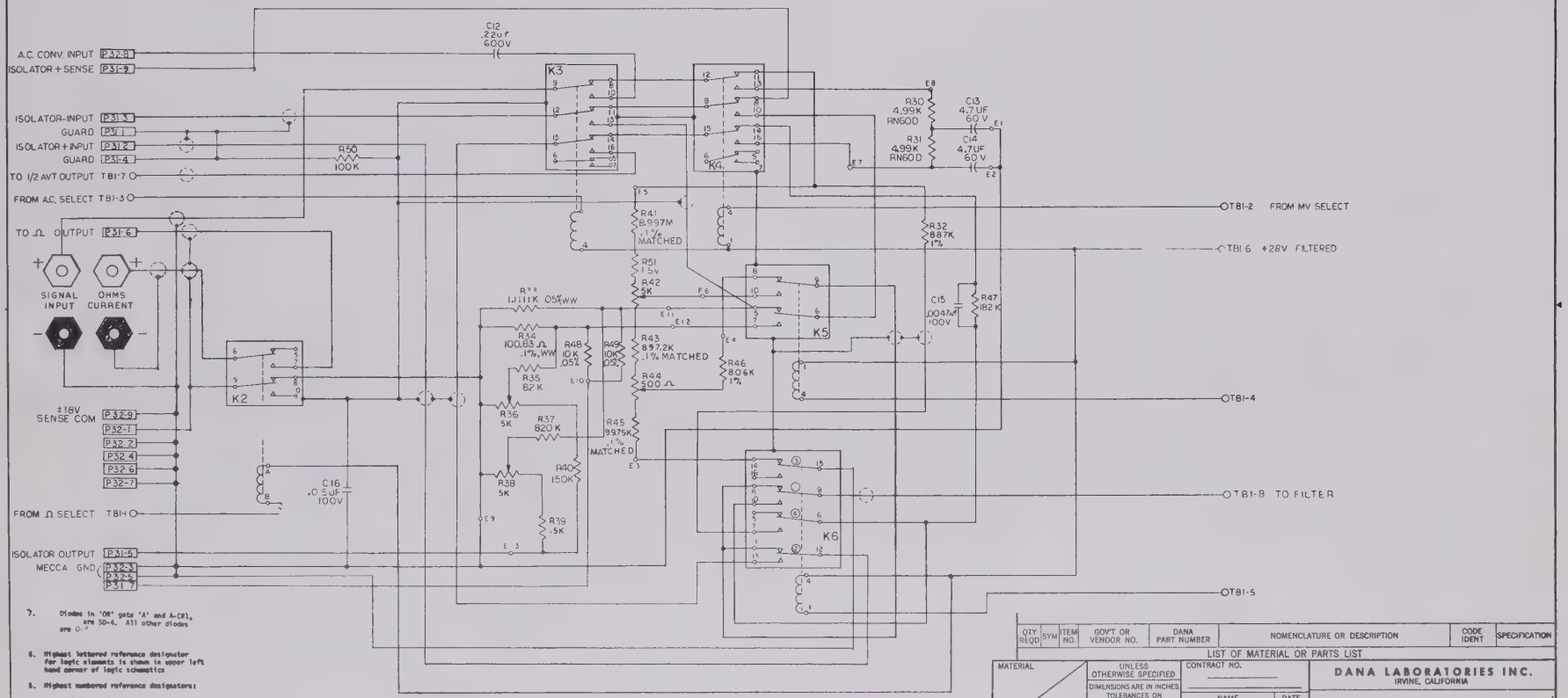
Rel 6-24-66
DRN=4458

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC - CONTROL & ATTENUATOR, 030

SIZE D | CODE IDENT NO. | DWG NO. 430310 | E

SCALE — | WT — | SHEET 1 OF 2




7. Diodes in 'OR' gate 'A' and A-CR1, are SD-4. All other diodes are D-7

6. Highest lettered reference designator for logic elements is shown in upper left hand corner of logic schematics

5. Highest numbered reference designators:

| | |
|---|---|
| R51 | Q18 |
| C16 | CR50 |

4. All voltages referenced to digital common

3. All transistors MPS 2N3646

2. All resistors 1/4W, 5%, carbon

1. All diodes D9P

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ± .030, XX ± .020, XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO. ——

| | NAME | DATE |
|---|---|---|
| DR | A. CHAUSSEE | 11-15-65 |
| CHK | | 11/17/65 |
| APPD | | 3-21-66 |

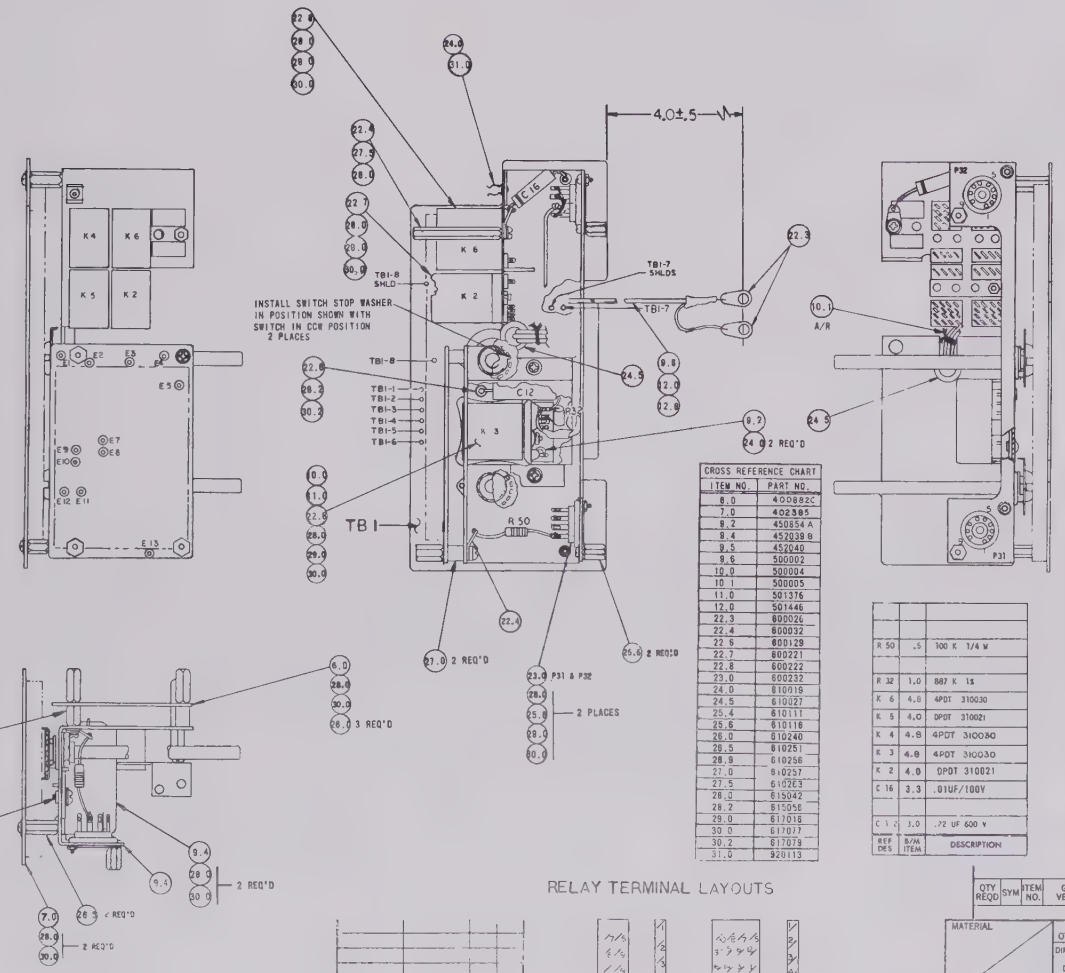
REQ 6-24-66
DRN 4575 B

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# SCHEMATIC – CONTROL ATTENUATOR, 030

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | —— | 430310 | L |

SCALE —— WT —— SHEET 2 OF 2




| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO. | PART NO. |
| 6.0 | 400882C |
| 7.0 | 402365 |
| 8.2 | 450854 A |
| 8.4 | 452039 B |
| 9.5 | 452040 |
| 9.6 | 500002 |
| 10.0 | 500004 |
| 10.1 | 500005 |
| 11.0 | 501376 |
| 12.0 | 501446 |
| 22.3 | 600026 |
| 22.4 | 600032 |
| 22.6 | 600128 |
| 22.7 | 600221 |
| 22.8 | 600222 |
| 23.0 | 600232 |
| 24.0 | 610019 |
| 24.5 | 610027 |
| 25.4 | 610111 |
| 25.6 | 610118 |
| 26.0 | 610240 |
| 26.5 | 610251 |
| 28.9 | 610256 |
| 27.0 | 610257 |
| 27.5 | 610263 |
| 28.0 | 615042 |
| 28.2 | 615056 |
| 29.0 | 617016 |
| 30.0 | 617017 |
| 30.2 | 617079 |
| 31.0 | 920113 |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| R 50 | .5 | 100 K 1/4 W |
| R 32 | 1.0 | 887 K 1% |
| K 6 | 4.8 | 4PDT 310030 |
| K 5 | 4.0 | DPDT 310021 |
| K 4 | 4.8 | 4PDT 310030 |
| K 3 | 4.8 | 4PDT 310030 |
| K 2 | 4.0 | DPDT 310021 |
| C 16 | 3.3 | .01UF/100V |
| C 12 | 3.0 | .22 UF 600 V |

| FROM | TO | CONDUCTOR USED; COLOR | B/M ITEM NO. | WIRE LENGTH | NOTES |
|---|---|---|---|---|---|
| P32-2 | P32-3 | BUSS WIRE | 10.0 | | |
| P32-3 | LUG | C16, .015UF/100V | 3.3 & 11.0 | | LEADS SLEEVED A/R |
| P32-3 | P32-4 | BUSS WIRE | 10.0 | | |
| P32-4 | P32-5 | BUSS WIRE | 10.0 | | |
| P32-5 | P32-6 | BUSS WIRE | 10.0 | | |
| P32-6 | P32-7 | BUSS WIRE | 10.0 | | |
| P32-7 | P32-8 | SLEEVED BUSS WIRE | 10.0 & 11.0 | | |
| TB1-1 | K2-4 | 9-1-2 | 16.0 | | VIA GROMMET (ITEM 24.5) |
| TB1-2 | K4-4 | 9-2 | 20.0 | | |
| TB1-3 | K3-1 | 9-3 | 20.5 | | |
| TB1-4 | K5-4 | 9-5-5 | 17.0 | | |
| TB1-5 | K6-1 | 5 | 14.5 | | |
| TB1-6 | K6-4 | 9-1-6 | 17.5 | | |
| TB1-7 | K3-16 | RG174/U | 12.0 | | |
| Shld to conn. | Shld not conn. | 0 | 12.8 & 9.6 | | TUBING AS REQ'D |
| TB1-8 | K6-9 | RG174/U | 12.0 | | |
| Shld to TB1-8 Shld | Shld not conn. | 0 | 12.8 & 9.6 | | VIA GROMMET (ITEM 24.5) TUBING AS REQUIRED |
| E-6 | K5-10 | 8 | 15.5 | | |
| E-11 | K5-5 | 9-1 | 19.0 | | |
| E-12 | K5-7 | 0 | 12.8 | | |
| E-3 | K6-14 | 2-1-1 | 13.5 | | |
| E-4 | K5-8 | 9-1-3 | 14.5 | | |
| E-8 | K4-11 | 9-1-0 | 13.0 | | |
| E-7 | K4-14 | 2-1-6 | 16.5 | | |
| E-5 | K4-11 | 9-1-7 | 18.0 | | |
| E-13 | P31-5 | 2-1-5 | 14.0 | | |
| E-9 | K2-8 | 2-1-3 | 14.0 | | |
| E-10 | P31-7 | 7-2-8 | 15.0 | | |
| K2-5 | K3-9 | 9-1-3 | 16.5 | | VIA GROMMET (ITEM 24.5) |
| K2-8 | P32-1 | 9-1-2 | 18.0 | | |
| K2-6 | g(Item no. 22.1) | RG174/U | 12.0 | | |
| Shld to K2-9 | Shld to lug(Item no. 22.1) | 0 | 12.8 & 9.6 | | TUBING AS REQ'D |
| K2-7 | P31-6 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-7 | 0 | 12.8 & 9.6 | | TUBING AS REQ'D |
| K2-9 | P32-1 | 9-1-5 | 17.0 | | VIA GROMMET (ITEM 24.5) |
| K3-8 | K4-1 | 9-1 | 19.0 | | |
| K3-12 | K4-15 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K3-11 | K4-9 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K3-8 | K4-12 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K3-13 | K5-5 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-1 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K3-10 | P32-8 | C12, .22UF/600V | 3.0 & 11.0 | | Leads Sleeved As Req'd |
| K3-15 | K6-15 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-4 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K3-12 | P31-3 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-4 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K3-9 | Lug(Item no. 22.2) | RG174/U | 12.0 | | |
| Shld to E32-9 | Shld to Lug(Item no. 22.2) | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K4-1 | K6-4 | 9-2-4 | 19.5 | | |
| K4-14 | K6-10 | SLEEVED BUSS WIRE | 10.0 & 11.0 | | |
| K4-11 | K6-7 | R32, 887K .1% | 1.0 & 11.0 | | Leads Sleeved As Req'd |
| K4-8 | P31-9 | 0-9 | 12.3 | | |
| K6-10 | K5 & | 9 | 22.1 | | |
| K5-9 | K6-8 | RG174/U | 12.0 | | |
| Shld to P31-4 | Shld not conn. | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K5-1 | K6-1 | 0 | 12.8 | | |
| K6-12 | P31-2 | RG174/U | 12.0 | | |
| Shld not conn. | Shld to P31-1 | 0 | 12.8 & 9.6 | | TUBING AS REQUIRED |
| K6-15 | P32-5 | 9 | 22.1 | | |
| K6-8 | K6-11 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| K6-6 | K6-10 | Sleeved Buss Wire | 10.0 & 11.0 | | |
| P31-1 | Lug(Item no. 22.4) | R50, 100K, 1/4 W | .5 & 11.0 | | Leads Sleeved As Req'd |

RELAY TERMINAL LAYOUTS

K5

K3,K4,K6

| 402428 | 031 | 1 | 1 |
|---|---|---|---|
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: .X ±.030, .XX ±.020, .XXX ±.010; ANGLES ±0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | R PRCHAL | 9-31-67 |
| CHK | [illegible] | [illegible] |
| APPD | [illegible] | [illegible] |

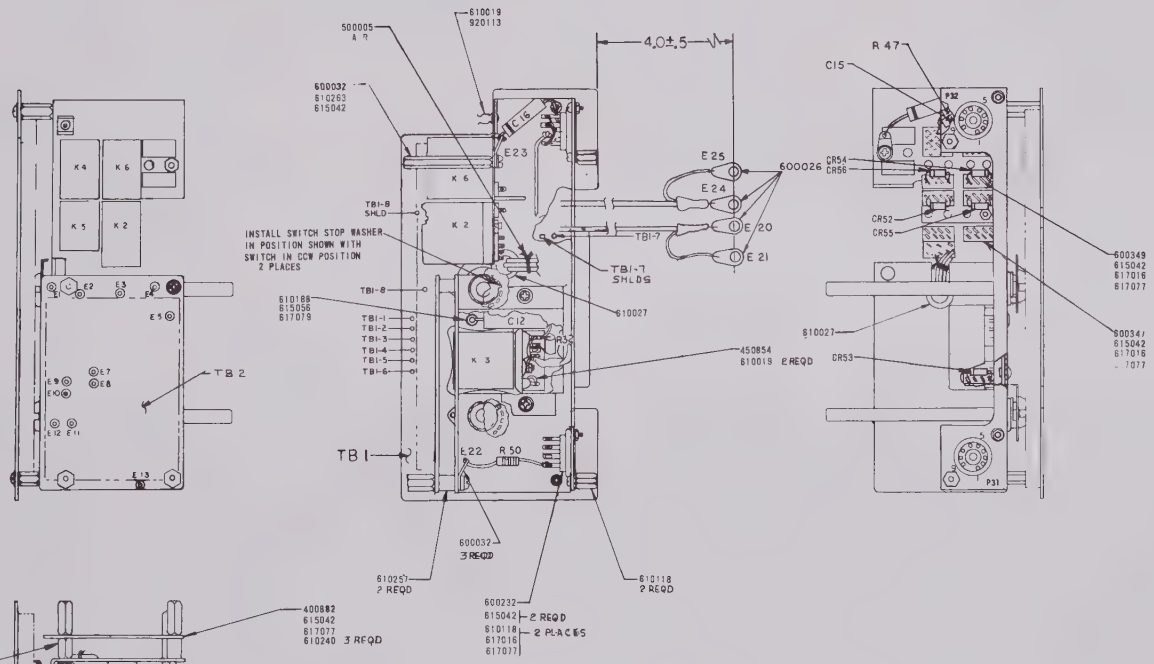
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

ATTENUATOR & CONTROL ASSY - MULTIMETER (031)

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 402384 | A |
| SCALE 1/1 | WT — | SHEET 1 OF 1 | |

NOTES: UNLESS OTHERWISE SPECIFIED

1. SCHEMATIC REFERENCE: 430310
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.
3. SCHEMATIC REFERENCE: 430310




3. ALL DIODES TYPE 018 5 REQD
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.
1. SCHEMATIC REFERENCE 430781

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|
| 1 | | 1 | | 402964 | 031-1 | | |
| 1 | | 2 | | 402963 | 031 | | |

LIST OF MATERIAL OR PARTS LIST

NEXT DWG | USED ON | NEXT ASSY | FINAL ASSY | QTY REQD

APPLICATION

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: X ± .030, XX ± .020, XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE BASE AXIS SHALL NOT EXCEED .010 TIR
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | J. Schultz | 30 OCT 1967 |
| CHK | [illegible] | 7-18-68 |
| APPD | D. Lange | 11/24 |
| | [illegible] | 7/12/68 |
| | [illegible] | 7-17-68 |

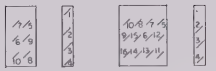
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# ATTENUATOR & CONTROL ASSY - MULTIMETER (031)

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 402966 | B |

SCALE 1/1 | WT | SHEET 1 OF 2

## RELAY TERMINAL OUTPUTS



K5 K3, K4, K6, K2

| REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|
| C12 | 120007 | 22UF/89V | 1 |
| C15 | 121146 | .0047UF/100V | 1 |
| C16 | 121090 | .015UF/100V | 4 |
| CR52 | 211083 | 018 | 5 |
| CR53 | ↑ | ↑ | REF |
| CR54 | ↓ | ↓ | ↑ |
| CR55 | | | ↓ |
| CR56 | 211083 | 018 | REF |
| K2 | 310030 | 4 PDT | 4 |
| K3 | 310030 | 4 PDT | REF |
| K4 | 310030 | 4 PDT | REF |
| K5 | 310021 | C PDT | 1 |
| K6 | 310030 | 4 PDT | REF |
| R32 | 010164 | 887k 1% | 1 |
| R47 | 010344 | 237k 1% | 1 |
| R50 | 000104 | 100k 1/4W | 1 |
| | 400882 | PCB ASSY-ATTEN | 1 |
| | 402967 | PCB ASSY SWITCH PANEL | 1 |
| | 430721 | SCHEM-CONTROL AND ATTEN 600B | REF |
| | 450854 | BRACKET RELAY MTG MULTI POLE | 1 |
| | 452039 | CHASSIS-CONTROL SWITCHING | 1 |
| | 452040 | SHIELD RELAY | 1 |
| | 500002 | TUBING SHRINK | A/R |
| | 500004 | BUSS WIRE | A/R |
| | 500003 | TIE CORD NYLON | A/R |

| P/N | DESCRIPTION | QTY |
|---|---|---|
| 501378 | TUBING 20 GA TEF | A/R |
| 501446 | CABLE RG174/U | A/R |
| 524000 | WIRE-24 GA STR 0 COLOR | A/R |
| 524090 | WIRE-24 GA STR 0-9 COLOR | A/R |
| 524206 | WIRE-24 GA STR 2-0-6 COLOR | A/R |
| 524211 | WIRE-24 GA STR 2-1-1 COLOR | A/R |
| 524215 | WIRE-24 GA STR 2-1-5 COLOR | A/R |
| 524555 | WIRE-24 GA STR 5-5-5 COLOR | A/R |
| 524728 | WIRE-24 GA STR 7-2-8 COLOR | A/R |
| 524888 | WIRE-24 GA STR 8 COLOR | A/R |
| 524912 | WIRE-24 GA STR 9-1-2 COLOR | A/R |
| 524913 | WIRE-24 GA STR 9-1-3 COLOR | A/R |
| 524915 | WIRE-24 GA STR 9-1-5 COLOR | A/R |
| 524916 | WIRE-24 GA STR 9-1-6 COLOR | A/R |
| 524917 | WIRE-24 GA STR 9-1-7 COLOR | A/R |
| 524918 | WIRE-24 GA SER 9-2-8 COLOR | A/R |
| 524919 | WIRE-24 GA STR 9-1 COLOR | A/R |

| P/N | DESCRIPTION | QTY |
|---|---|---|
| 524924 | WIRE-24 GA STR 9-2-4 COLOR | A/R |
| 524929 | WIRE-24 GA STR 9-2 COLOR | A/R |
| 524939 | WIRE-24 GA STR 9-3-9 COLOR | A/R |
| 524928 | WIRE-24 GA STR 9-2 8 COLOR | A/R |
| 524999 | WIRE-24 GA STR 9 COLOR | A/R |
| 600026 | LUG-SOLDER #10 | 4 |
| 600032 | LUG-SOLDER #4 | 3 |
| 600188 | INSULATOR-1451 USECO | 1 |
| 600232 | SOCKET-9 PIN | 2 |
| 600347 | SOCKET RELAY 2 POLE SOLDER TERM | 1 |
| 600349 | SOCKER RELAY 4 POLE SOLDER TERM | 4 |
| 610019 | RIVET 1/8 SEMI-TUB X 5/32 LG | 3 |
| 610027 | GROMMET-RUB BLK | 2 |
| 610111 | NUT PRESS #4-40 | 1 |

NOTES UNLESS OTHERWISE SPECIFIED

| NEXT DWG | USED ON | NEXT DWG | FINAL ASSY |
|---|---|---|---|
| 402964 | 031-1 | | |
| 402962 | 031 | | |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: X .030, XX .020, XXX .010 | ANGLES: 0 30' FORMED 1 0° | HOLE DIAMETERS: .004, .001

MATERIAL

FINISH

DRAWN 9-23-68

CHECK

DESIGN

MECH ENGR

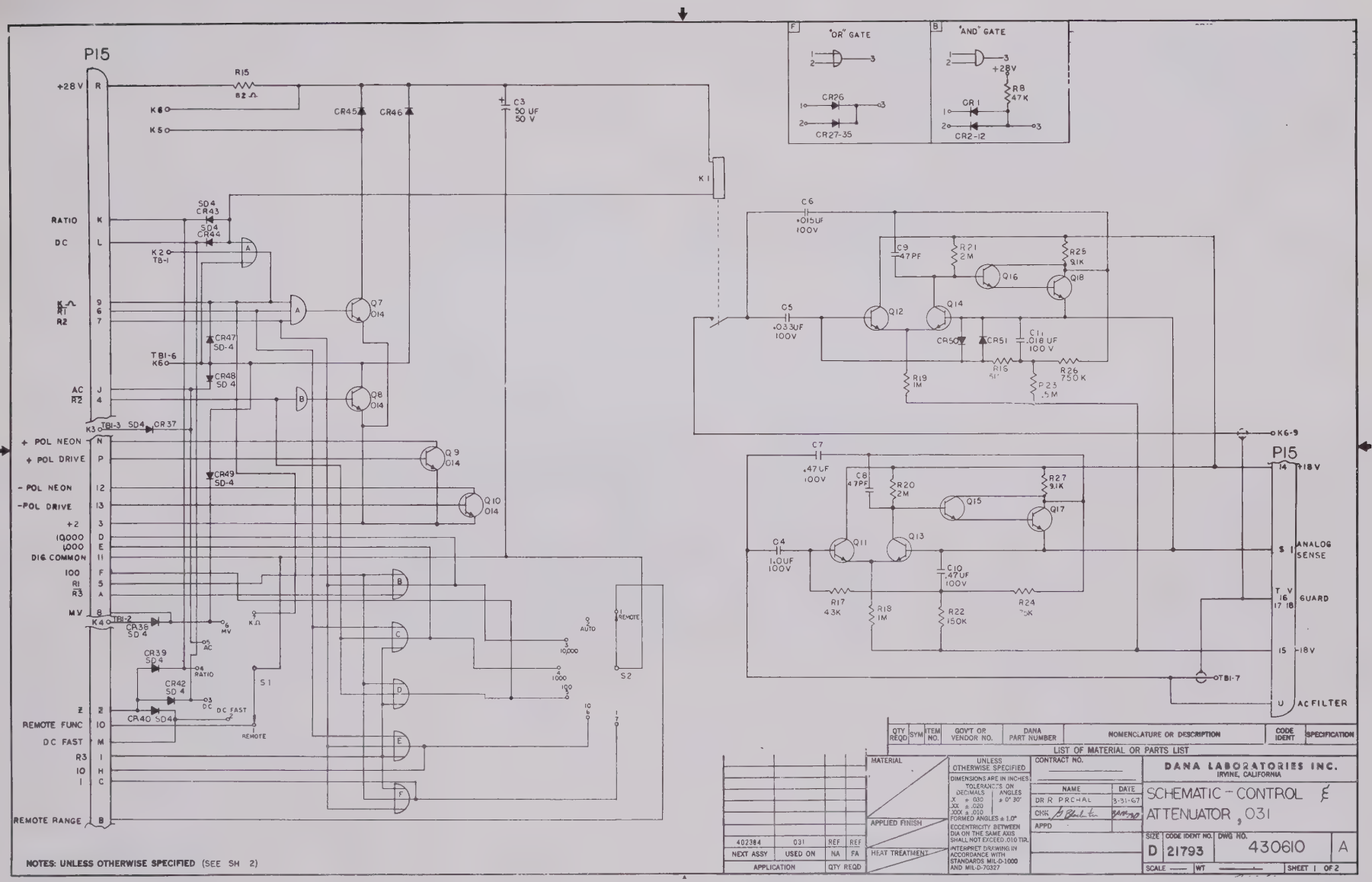
PROJ ENGR

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# ATTENUATOR & CONTROL ASSY-MULTIMETER (031)

| SIZE | CODE IDENT NO | DWG NO | REV |
|---|---|---|---|
| D | 21793 | 402966 | B |

SCALE 1/1 SHEET 2 OF 2




| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| 402384 | 031 | REF | REF |
|---|---|---|---|
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ± .030, .XX ± .020, .XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

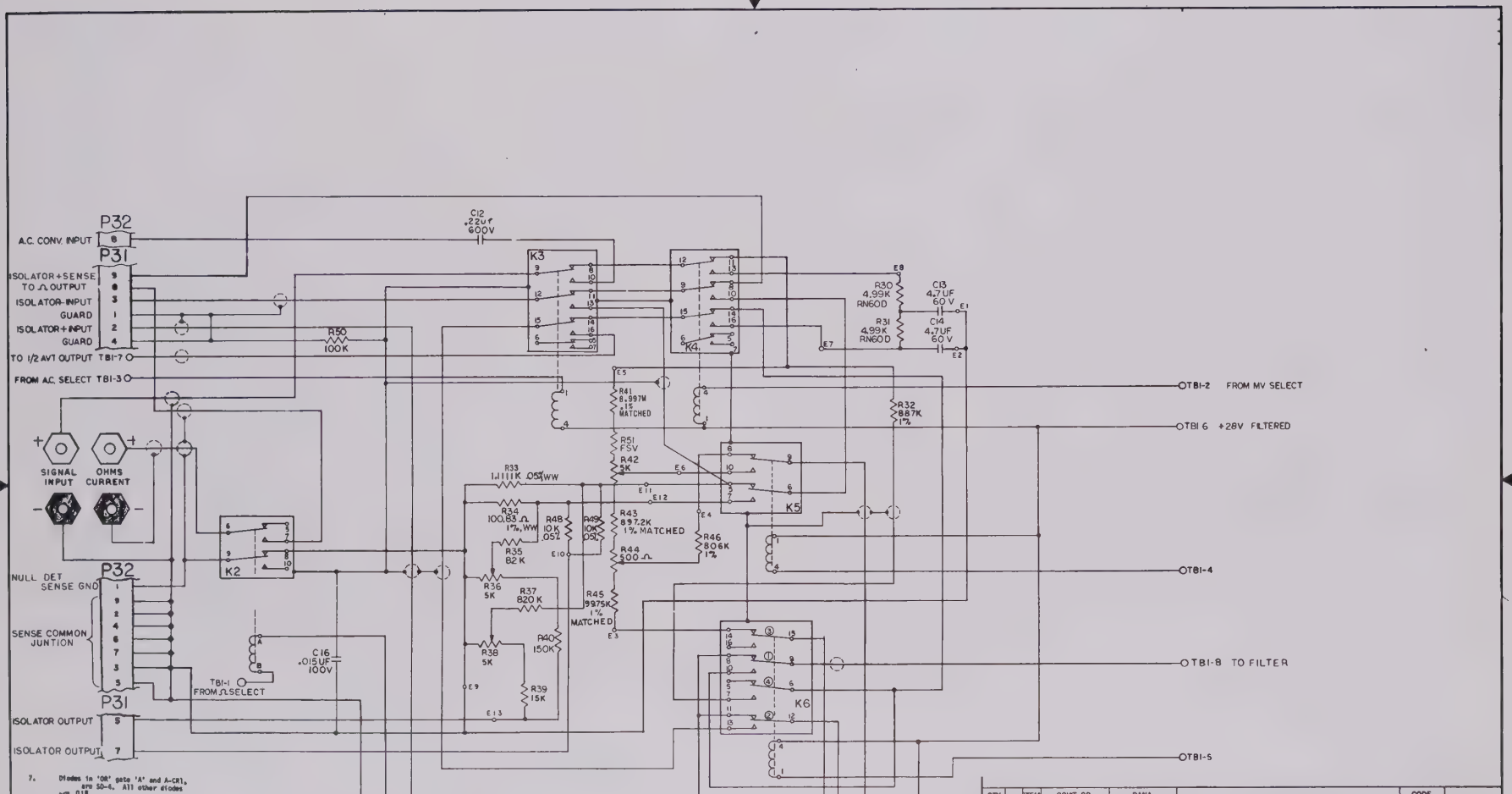
| | NAME | DATE |
|---|---|---|
| DR | R PRCHAL | 3-31-67 |
| CHK | | |
| APPD | | |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC - CONTROL & ATTENUATOR, 031

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 430610 | A |

SCALE — WT — SHEET 1 OF 2




7. Diodes in 'OR' gate 'A' and A-CR1, are SD-4. All other diodes are .018

6. Highest lettered reference designator for logic elements is shown in upper left hand corner of logic schematics.

5. Highest numbered reference designators:
   C18, CR81, Q18, R51

4. All voltages referenced to digital common.

3. All transistors NPN 2N3646.

2. All resistors 1/4W, 5%, carbon.

1. All diodes 018.

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| | | | |
|---|---|---|---|
| 402384 | 031 | REF | REF |
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: .X ± .030, .XX ± .020, .XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | R PRCHAL | 3-31-67 |
| CHK | | |
| APPD | | |

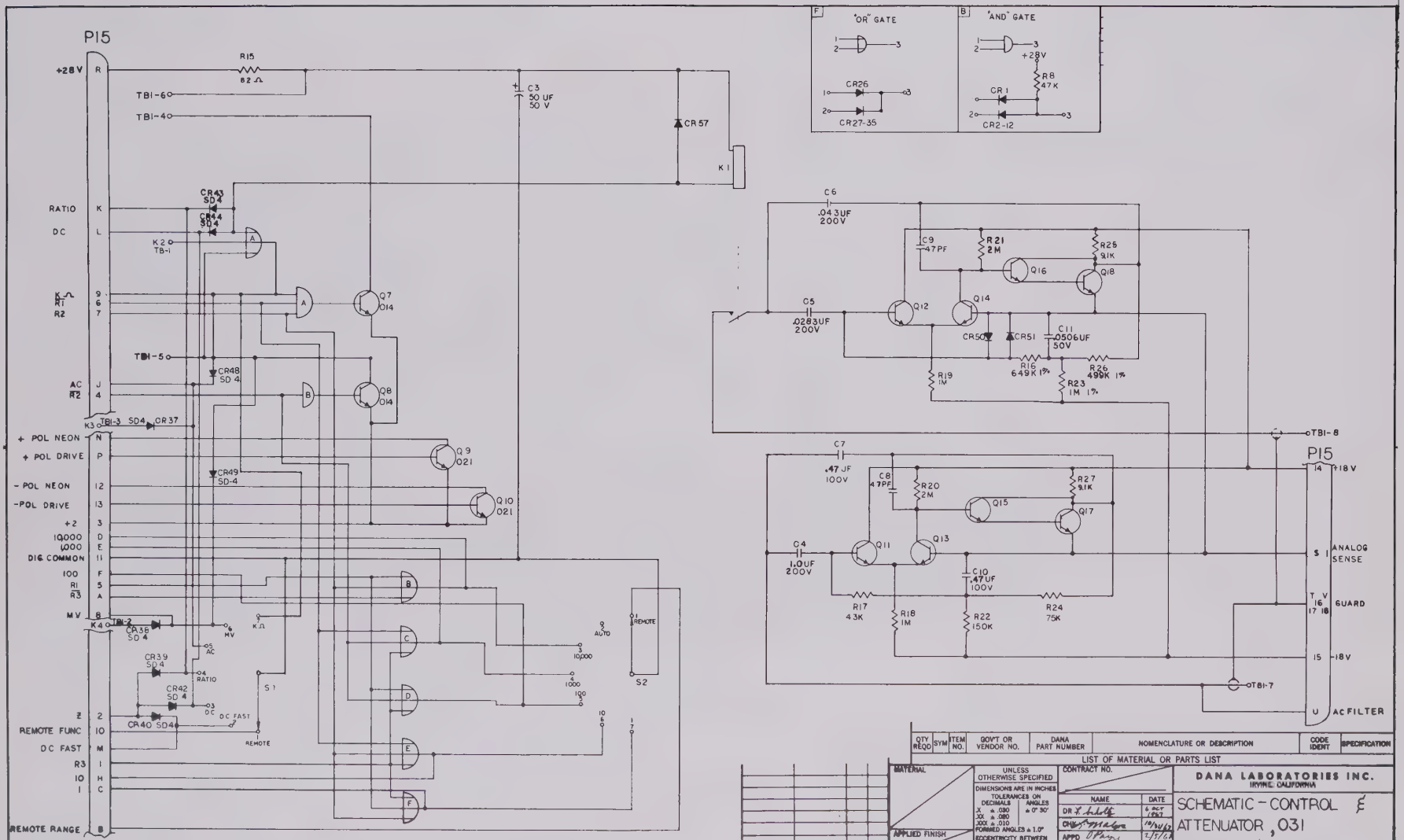
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC – CONTROL ATTENUATOR, 031

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 430610 | A |

SCALE —— WT —— SHEET 2 OF 2

FORM A 8470-1




| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| 402587 | 031 | REF | REF |
|---|---|---|---|
| NEXT ASSY | USED ON | MA | FA |
| APPLICATION | | QTY REQD | |

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ± .030, XX ± .080, XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-S-70187

CONTRACT NO.

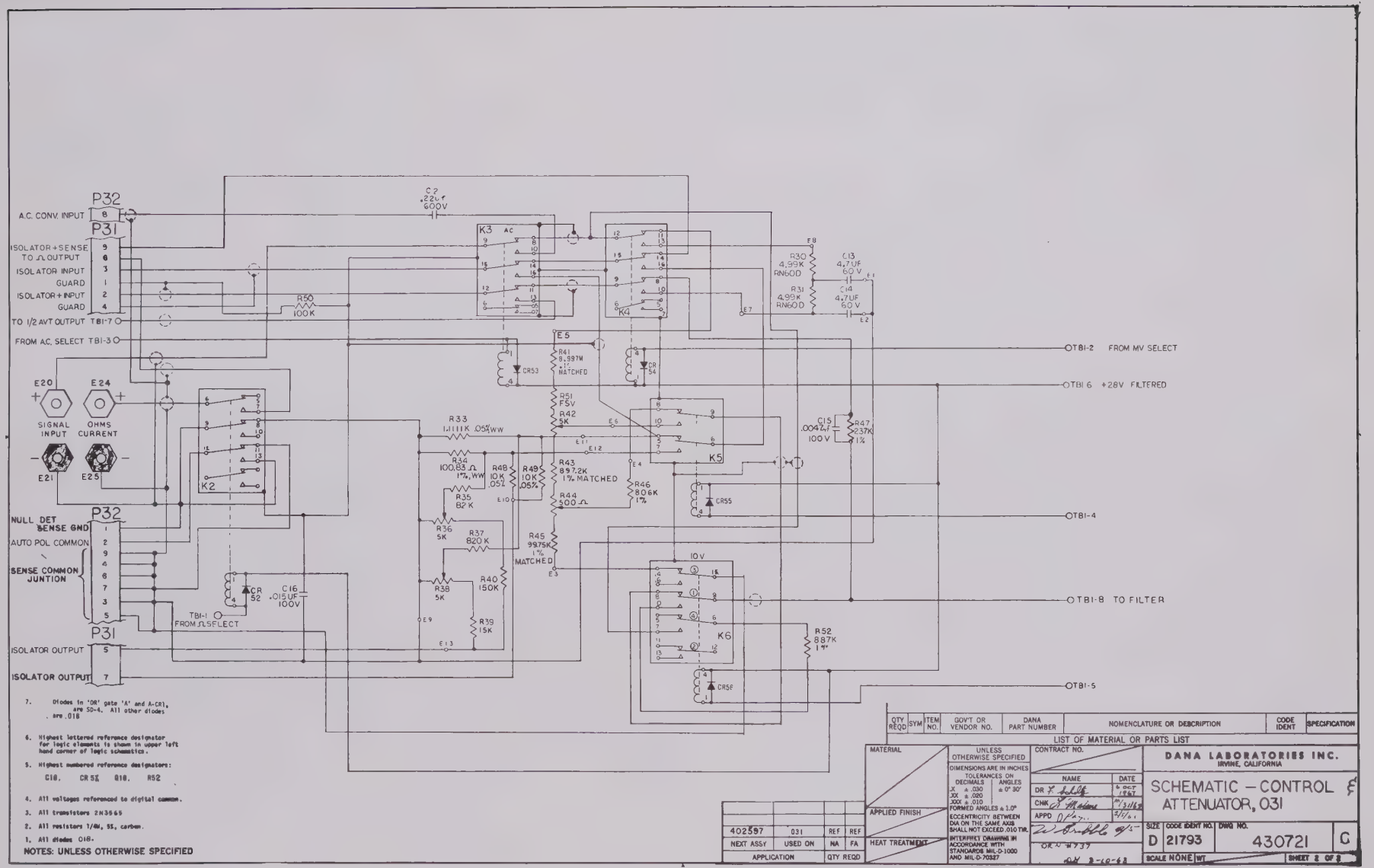
| | NAME | DATE |
|---|---|---|
| DR | [illegible] | 6 OCT 1961 |
| CHK | [illegible] | 10/11/62 |
| APPD | D Pain | 2/15/62 |
| | [illegible] | 3/6 |
| | DRW 8939 | |
| | RH 4-18-62 | |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC - CONTROL ATTENUATOR, 031

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 430721 | C |

SCALE NONE | WT | SHEET 1 OF




7. Diodes in 'OR' gate 'A' and A-CR1, are SD-4. All other diodes are .018

6. Highest lettered reference designator for logic elements is shown in upper left hand corner of logic schematics.

5. Highest numbered reference designators:
   C18, CR 56, Q18, R52

4. All voltages referenced to digital common.

3. All transistors 2N3565

2. All resistors 1/4W, 5%, carbon.

1. All diodes O18.

**NOTES: UNLESS OTHERWISE SPECIFIED**

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| 402597 | 031 | REF | REF |
|---|---|---|---|
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS .X ± .030, .XX ± .020, .XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.
ORN #439

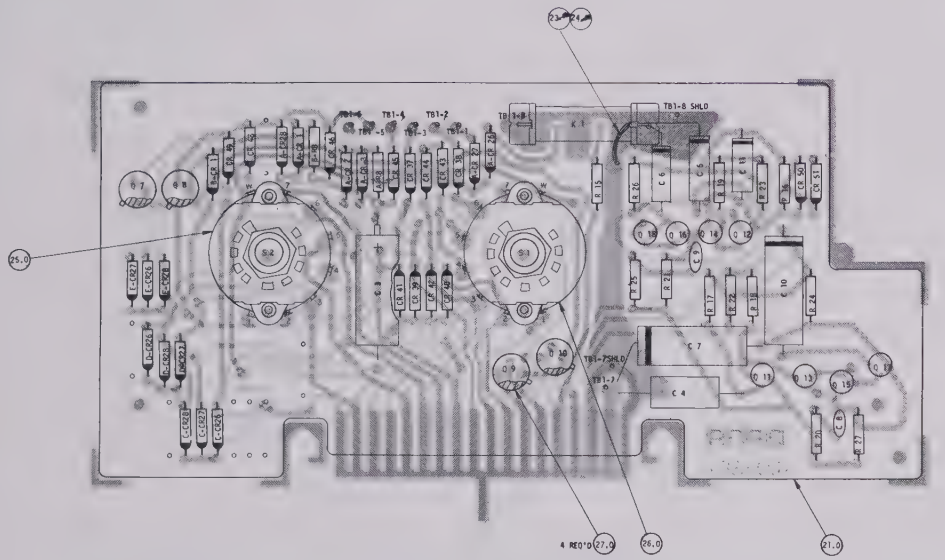
| | NAME | DATE |
|---|---|---|
| DR | Y. Lobl | 6 OCT 1967 |
| CHK | R. Malone | 10/31/67 |
| APPD | N. Hayes | 11/1/67 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# SCHEMATIC — CONTROL & ATTENUATOR, 031

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 430721 | C |

SCALE NONE WT SHEET 2 OF 3




| | | |
|---|---|---|
| | | |
| CR 46 | 19.0 | 018 |
| CR 45 | 19.0 | 018 |
| CR 44 | 18.0 | SD4 |
| ↓ | ↓ | ↓ |
| thru | | |
| ↓ | ↓ | ↓ |
| CR 37 | 18.0 | SD4 |
| | | |
| | | |
| CR 28 | 19.0 | 018 |
| A-CR23 | 18.0 | SD4 |
| CR 27 | 19.0 | 018 |
| A-CR27 | 18.0 | SD4 |
| CR 26 | 19.0 | 018 |
| A-CR24 | 18.0 | SD4 |
| | | |
| CR 4 | 19.0 | 018 |
| CR 3 | 19.0 | 018 |
| | | |
| B-CR1 | 19.0 | 018 |
| A-CR2 | 19.0 | 018 |
| A-CR1 | 18.0 | SD4 |
| | | |
| | | |
| C 11 | 12.5 | .018 MFD 100 V |
| C 10 | 12.6 | .27 MFD 100 V |
| C 9 | 10.0 | 47 PF DISC |
| C 8 | 10.0 | 47 PF DISC |
| C 7 | 14.0 | .22 MFD 100 V |
| C 6 | 13.5 | .015 MFD 100 V |
| C 5 | 15.0 | .033 MFD 100 V |
| C 4 | 12.3 | .47 MFD 100 V |
| C 3 | 11.0 | 50 MFD 50 V |
| REF DES | B/M ITEM | DESCRIPTION |

| | | |
|---|---|---|
| Q 18 | 17.0 | 2N3565 |
| ↓ | ↓ | ↓ |
| thru | | |
| ↓ | ↓ | ↓ |
| Q 11 | 17.0 | 2N3565 |
| Q 10 | 16.0 | 014 |
| ↓ | ↓ | ↓ |
| Q 7 | 16.0 | 014 |
| | | |
| | | |
| R 27 | 8.0 | 9.1 K |
| R 26 | 6.6 | 750K |
| R 25 | 8.0 | 9.1 K |
| R 24 | 6.5 | 75K |
| R 23 | 2.1 | 1.5 MEG |
| R 22 | 2.0 | 150K |
| R 21 | 3.0 | 2 MEG |
| R 20 | 3.0 | 2 MEG |
| R 19 | 1.0 | 1 MEG |
| R 18 | 1.0 | 1 MEG |
| R 17 | 4.0 | 43 K |
| R 16 | 6.0 | 510 K |
| R 15 | 7.0 | 82 OHMS |
| R 8 | 5.0 | 47 K |
| | | |
| | | |
| K 1 | 20.0 | RELAY 310013 |
| | | |
| | | |
| CR 51 | 19.0 | 018 |
| CR 50 | 19.0 | 018 |
| CR 49 | 18.0 | SD4 |
| CR 48 | 18.0 | SD4 |
| REF DES | B/M ITEM | DESCRIPTION |

| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO. | PART NO. |
| 21.0 | 402884 |
| 23.0 | 500004 |
| 24.0 | 501376 |
| 25.0 | 500218 |
| 26.0 | 500236 |
| 27.0 | 920006 |

3. SCHEMATIC REFERENCE: 430464
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS
1. All resistors 1/4W, 5%, Carbon.

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: .X ± .030, .XX ± .020, .XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

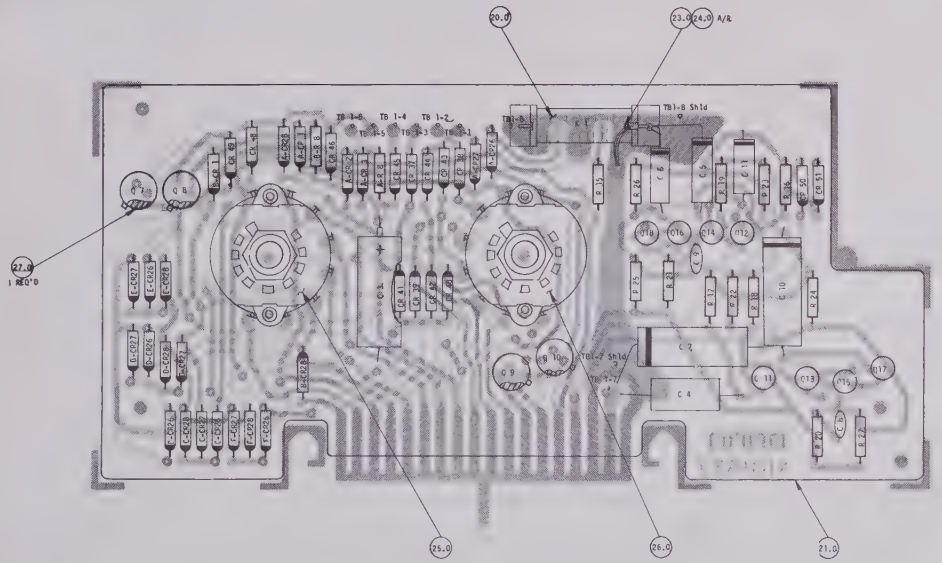
| | NAME | DATE |
|---|---|---|
| DR | J MONROY | 2 AUG 65 |
| CHK | | 9-2-1965 |
| APPD | | 9/2/65 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

PC BOARD ASSY — SWITCH PANEL , 020

| SIZE | CODE IDENT NO. | DWG NO. |
|---|---|---|
| D | | 402158 C |

SCALE 2/1 | WT | SHEET 1 OF 1




| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| CR45 | 19.0 | O1B |
| CR44 | 18.0 | SD 4 |
| Thru | | |
| CR37 | 18.0 | SD 4 |
| CR28 | 19.0 | O1B |
| A-CR24 | 18.0 | SD 4 |
| CR27 | 19.0 | O1B |
| A-CR2 | 18.0 | SD 4 |
| CR26 | 19.0 | O1B |
| A-CR26 | 18.0 | SD 4 |
| CR 4 | 19.0 | O1B |
| CR 3 | 19.0 | O1B |
| B-CR1 | 18.0 | O1B |
| A-CR2 | 18.0 | O1B |
| A-CR1 | 18.0 | SD 4 |
| C 11 | 12.0 | .018 uf/100V |
| C 10 | 12.1 | .27 uf / 100 V |
| C 9 | 10.0 | 47 pf DISC |
| C 8 | 10.0 | 47 pf DISC |
| C 7 | 15.0 | .22 MFD 100 V |
| C 6 | 13.0 | .015 MFD 100 V |
| C 5 | 14.0 | .033 MFD 100 V |
| C 4 | 11.5 | .47 MFD 100 V |
| C 3 | 11.5 | 50 MFD 50 V |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| Q 18 | 16.0 | 2N3565 |
| Thru | | |
| Q 11 | 16.0 | 2N3565 |
| Q 10 | 15.1 | O14 |
| Q 7 | 15.7 | O14 |
| R 27 | 8.0 | 9.1 K |
| R 26 | 6.6 | 750 K |
| R 25 | 8.0 | 9.1 K |
| R 24 | 6.5 | 75 K |
| R 23 | 3.0 | 1.5 MEG |
| R 22 | 2.9 | 150 K |
| R 21 | 4.0 | 2 Meg |
| R 20 | 4.0 | 2 Meg |
| R 19 | 1.0 | 1 Meg |
| R 18 | 1.0 | 1 Meg |
| R 17 | 5.0 | 43 K |
| R 16 | 6.0 | 510 K |
| R 15 | 7.0 | 82 ohms |
| R 8 | 9.5 | 47K |
| CR 51 | 19.0 | O1B |
| CR 50 | 19.0 | O1B |
| CR 49 | 18.0 | SD 4 |
| CR48 | 18.0 | SD4 |
| CR 46 | 19.0 | O1B |

| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO. | PART NO. |
| 20.0 | 1100134 |
| 21.0 | 610185-7 |
| 23.0 | 500004 |
| 24.0 | 501376 |
| 25.0 | 600218 |
| 26.0 | 600236 |
| 27.0 | 520006 |

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ± .030, XX ± .020, XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1 0°
ECCENTRICITY BETWEEN D/A ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE W TH STANDARDS MIL D-1000 AND MIL D 70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | | 11-15-65 |
| CHK | | 11-17-65 |
| APPD | | 11-18-65 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

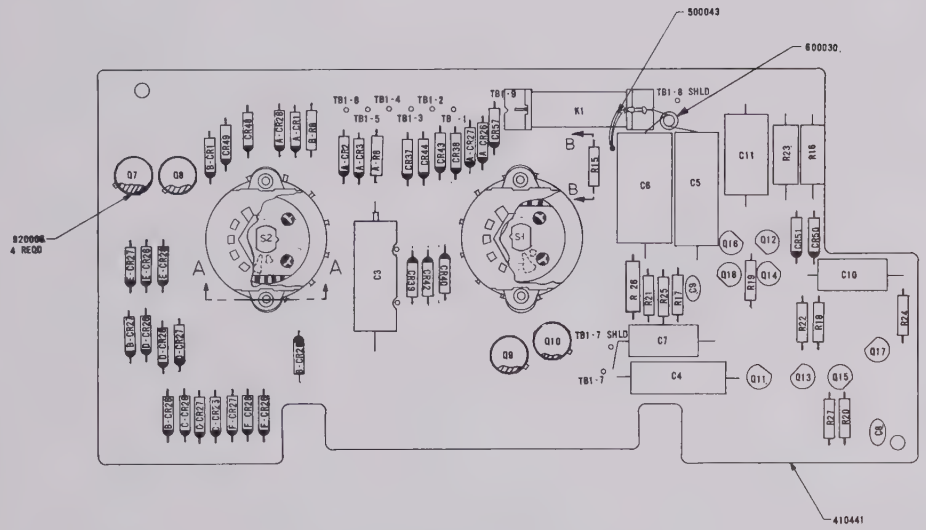
P.C. BOARD ASSY - SWITCH PANEL, 030

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | ——— | 400704 | H |

SCALE 2:1 | WT ——— | SHEET 1 OF 1

3. SCHEMATIC REFERENCE: 430310
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.
1. All resistors 1/4W, 5%, Carbon

NOTES: UNLESS OTHERWISE SPECIFIED



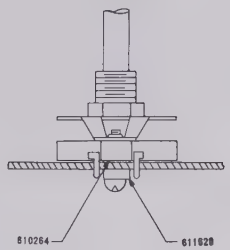

| REF DES | PART NO | DESCRIPTION | QTY |
|---|---|---|---|
| CR49 | 210004 | SD4 | 13 |
| CR48 | 210004 | SD4 | REF |
| | | | |
| CR46 | 210004 | SD4 | REF |
| THRU | ↕ | ↕ | ↕ |
| CR37 | 210004 | SD4 | REF |
| CR28 | 211083 | 018 | 21 |
| THRU | ↕ | ↕ | ↕ |
| CR26 | 211083 | 018 | REF |
| A-CR28 | 210004 | SD4 | REF |
| | | | |
| A-CR28 | 210004 | SD4 | REF |
| CR3 | 211083 | 018 | REF |
| THRU | ↕ | ↕ | ↕ |
| CR1 | 211083 | 018 | REF |
| A-CR1 | 210004 | SD4 | REF |
| | | | |
| | | | |
| C11 | 120148 | .0506UF/50V | 1 |
| C10 | 120026 | 47UF/100V | 2 |
| C9 | 101182 | 47pF DISC | 2 |
| C8 | 101182 | 47pF DISC | REF |
| C7 | 120026 | 47UF/1100V | REF |
| C6 | 120146 | 043UF,200V | 1 |
| C5 | 120147 | .0283UF,200V | 1 |
| C4 | 120012 | 1UF/200V | 1 |
| C3 | 110044 | 500F/50V | 1 |
| | | | |
| | | | |
| | | | |
| S2 | 600415 | SWITCH,ROT | 1 |
| S1 | 600416 | SWITCH,ROT | 1 |
| | | | |
| R27 | 000912 | 9.1k | 2 |
| R26 | 010149 | 499k 1% | 1 |

| REF DES | PART NO. | DESCRIPTION | QTY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| R25 | 000912 | 9.1k | REF |
| R24 | 000753 | 75k | 1 |
| R23 | 010343 | 1 MEG 1% | 1 |
| R22 | 000154 | 150k | 1 |
| R21 | 000205 | 2 MEG | 2 |
| R20 | 000205 | 2 MEG | REF |
| R19 | 000105 | 1 MEG | 2 |
| R18 | 000105 | 1 MEG | REF |
| R17 | 000433 | 43k | 1 |
| R16 | 010342 | 549k 1% | 1 |
| R15 | 000820 | 82 OHMS | 1 |
| R8 | 000473 | 47k | 2 |
| | | | |
| Q18 | 200043 | 2N3565 | 8 |
| THRU | ↕ | ↕ | ↕ |
| Q11 | 200043 | 2N3565 | REF |
| Q10 | 200079 | Q21 | 2 |
| Q9 | 200079 | Q21 | REF |
| Q8 | 200035 | Q14 | 2 |
| Q7 | 200035 | Q14 | REF |
| | | | |
| K1 | 310013 | RELAY | 1 |
| | | | |
| | | | |
| CR57 | 211083 | 018 | REF |
| THRU | ↕ | ↕ | ↕ |
| CR50 | 211083 | 018 | REF |

| REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|
| | 410441 | PCB SWITCH PNL | 1 |
| | 420442 | ARTWORK SWITCH PANEL | REF |
| | 500004 | WIRE 22 GA | A/R |
| | 501376 | TUBING 20 GA | A/R |
| | 600030 | TERMINAL TBFOON | 1 |
| | 600415 | SWITCH ROTARY 7 POS 1 POLE | 1 |
| | 600416 | SWITCH ROTARY 6 POS 1 POLE | 1 |
| | 610264 | WASHER INSUL .25 X .12 X .020 THK | 4 |
| | 611620 | WASHER FIBER | 4 |
| | 920006 | TRANS PAD LARGE | 4 |
| | 920010 | SOLDER BAR | A/R |

## SECTION A-A

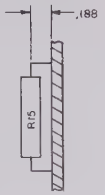
TYP 4 PLACES




## SECTION B-B

SCALE: 4/1

TYP 1 PLACE




| | | | |
|---|---|---|---|
| 402966 | 031 | 1 | 1 |
| 402598 | 031 | 1 | 1 |
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

3. SCHEMATIC REFERENCE: 430721
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS
1. ALL RESISTORS 1/4W ± 5%, CARBON

NOTE: UNLESS OTHERWISE SPECIFIED

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS X .030 XX .020 XXX .010 | ANGLES 0° 30' | FORMED ANGLES 1.0

MATERIAL

FINISH

CONTRACT NO.

DRAWN Curt Trudeau 6 MAY 968

CHECK [illegible] 7-12-68

DESIGN [illegible] 7-11-68

PROJ ENGR [illegible] 7-19-68

Chgd. 7/22 C. Mgd. 7/23

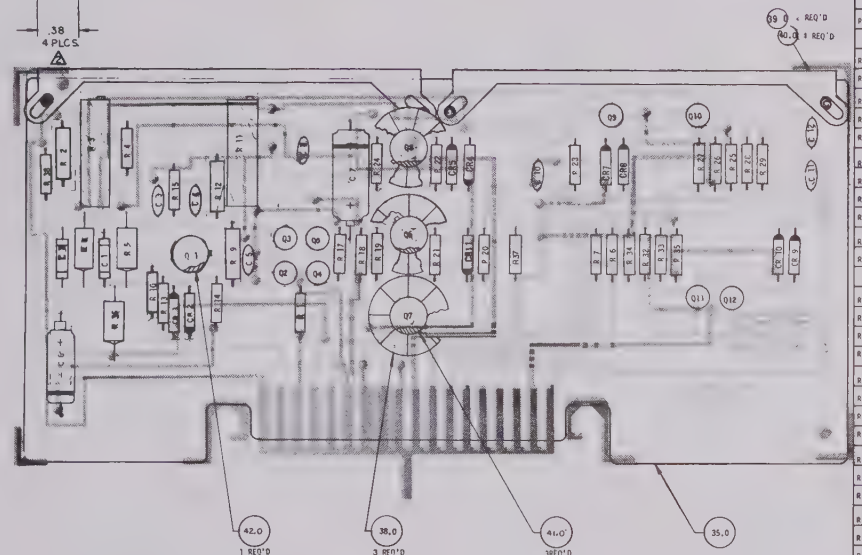
**DANA LABORATORIES INC.**
IRVINE, CALIFORNIA

# P.C. BOARD ASSY - SWITCH PANEL, 031

| SIZE | CODE IDENT NO. | DWG NO. | REV |
|---|---|---|---|
| D | 21793 | 402967 | A |

SCALE 2/1 WT SHEET 1 OF 1

AUTO. POLARITY 402056 SERIAL NO. DANA




| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| | | |
| P 29 | 3.0 | 15 K |
| | | |
| R 27 | 3.0 | 15 K |
| R 26 | 5.0 | 18 K |
| R 25 | 3.0 | 15 K |
| R 24 | 13.0 | 47 ohms |
| R 23 | 7.0 | 200 ohms |
| R 22 | 2.0 | 10 K |
| R 21 | 15.0 | ¼ ohms |
| R 20 | 8.0 | 4.7 K |
| R 19 | 15.0 | 91 ohms |
| R 18 | 14.0 | 4.7 K |
| R 17 | 1.0 | 1 K |
| | | |
| R 15 | 1.0 | 1 K |
| R 14 | 6.0 | 160 K |
| R 13 | 6.0 | 180 K |
| R 12 | 16.0 | 422 K (1%) |
| R 11 | 20.0 | 50 K (POT$_1$) |
| R 10 | 1.0 | 1 K |
| R 9 | 16.0 | 422 K (1%) |
| R 8 | 18.0 | 10 K (.05%) |
| R 7 | 9.0 | 24 K |
| R 6 | 9.0 | 24 K |
| R 5 | 18.0 | 10 K (.05%) |
| R 4 | 12.0 | 39 K |
| R 3 | 19.0 | 5 K (POT$_1$) |
| R 2 | 7.0 | 100 ohms (1%) |
| R 1 | 8.0 | 2 K |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| C 8 | 22.0 | 100 pf |
| C 7 | 23.0 | 25 MFD 50V |
| C 6 | 24.0 | 5 MFD 50 V |
| C 5 | 22.0 | 100 pf |
| C 4 | 22.0 | 100 pf |
| C 3 | 22.0 | 100 pf |
| C 2 | 26.0 | 24 pf 36 |
| C 1 | 26.0 | 24 pf 36 |
| | | |
| | | |
| CR 11 | 34.0 | 1/4 M2.4 A25 |
| CR10 | 33.0 | 018 |
| CR 9 | 33.0 | 018 |
| CR 7 | 33.0 | 018 |
| CR 6 | 33.0 | 018 |
| CR 5 | 32.0 | ~~5-325~~ |
| CR 4 | 32.0 | ~~+ 325~~ 1N540 |
| CR 2 | 33.0 | 018 |
| | | |
| CR 1 | 33.0 | 018 |
| | | |
| R38 | 3.5 | 7.7 K |
| R 37 | 11.0 | 390 OHMS |
| R 36 | 18.0 | 10 K (.05%) |
| R 35 | 10.0 | 30 K |
| R 34 | 4.0 | 16 K |
| R 33 | 10.0 | 30 K |
| R 32 | 4.0 | 16 K |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Q 12 | 29.0 | 2N3646 |
| Q 11 | 29.0 | 2N3646 |
| Q 10 | 31.0 | 2N3565 |
| Q 9 | 31.0 | 2N3565 |
| Q 8 | 28.0 | 014 |
| Q 7 | 28.0 | 014 |
| Q 6 | 27.0 | 009 |
| Q 5 | 29.0 | 2N3646 |
| Q 4 | 29.0 | 2N3646 |
| Q 3 | 31.0 | 2N3565 |
| Q 2 | 31.0 | 2N3565 |
| Q 1 | 31.5 | 016 SELECTED |
| | | |
| | | |
| | | |
| C 12 | 21.0 | 330 pf |
| C 11 | 21.0 | 330 pf |
| C 10 | 22.0 | 100 pf |

| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO | PART NO. |
| 35.0 | 41024-B |
| 36.0 | 600016 |
| 39.0 | 610235 |
| 40.0 | 610237 |
| 41.0 | 920006 |
| 42.0 | 920082 |

4 SCHEMATIC REFERENCE: 430415

3. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.

⚠ Resist stamp .10 high black characters and .15 high logo, located as shown

1. All resistors are 1/6W, .5% tolerance.

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS | ANGLES
X ± .030 | ± 0° 30'
XX ± .020
XXX ± .010
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D 1000 AND MIL-D 70327

CONTRACT NO.

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

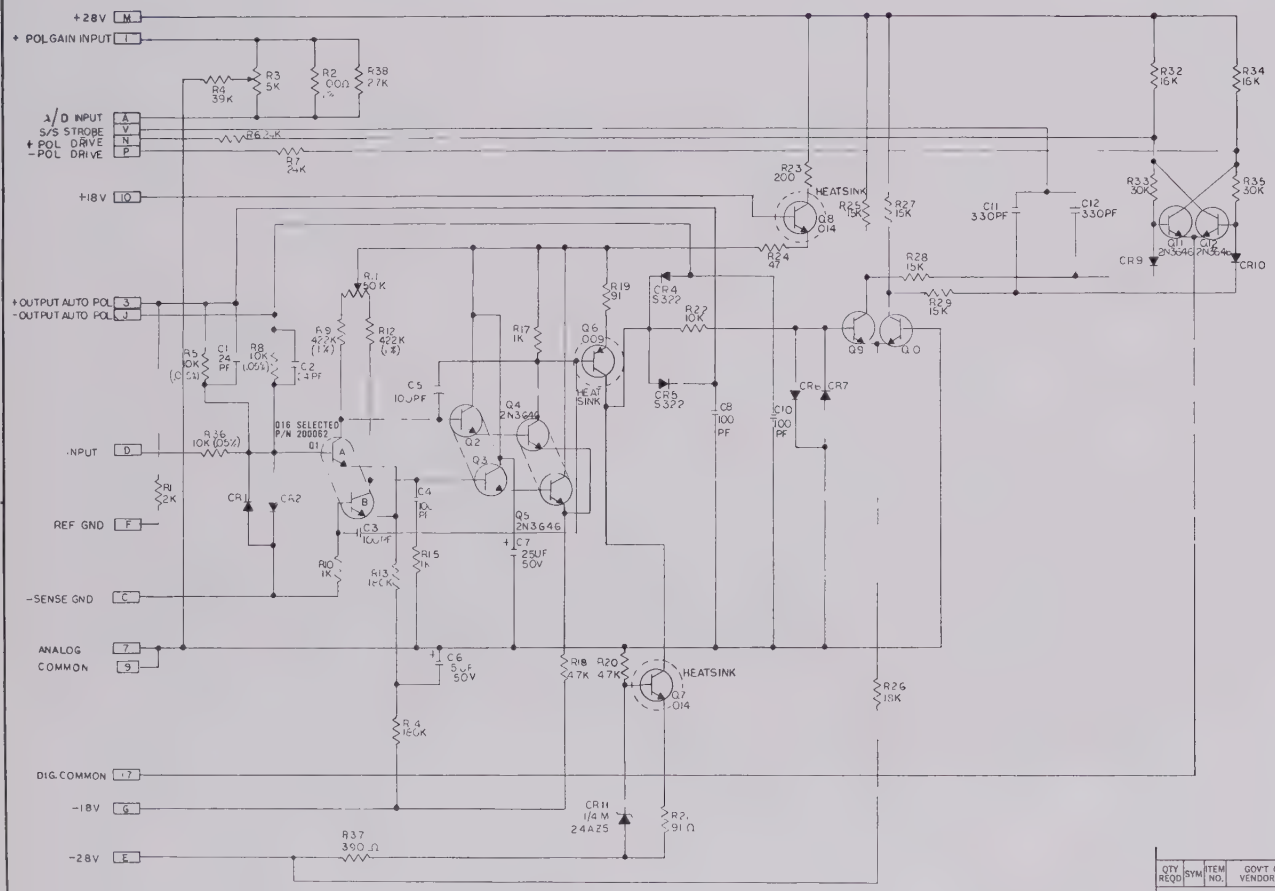
| | NAME | DATE |
|---|---|---|
| DR | [illegible] | 6-2-66 |
| CHK | [illegible] | 6-2-66 |
| APPD | [illegible] | 6/3/66 |

Rel 6-2-66
DRN # 430813

P C BOARD ASS'Y
AUTO POLARITY

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | — | 402056 | K |

SCALE — WT — SHEET 1 OF 1




5. Highest numbered reference designator:

| R38 | R12 |
|---|---|
| C12 | C R11 |

4. All voltages referenced to analog common
3. All transistors 2N3565
2. All resistors 1/8W, 5%, carbon
1. All diodes 018

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .X ± .030, .XX ± .020, .XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL D-1000 AND MIL-D-70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | [illegible] | 1. 4 61 |
| CHK | [illegible] | 9 JUNE 1966 |
| APPD | [illegible] | 5/1/14 |

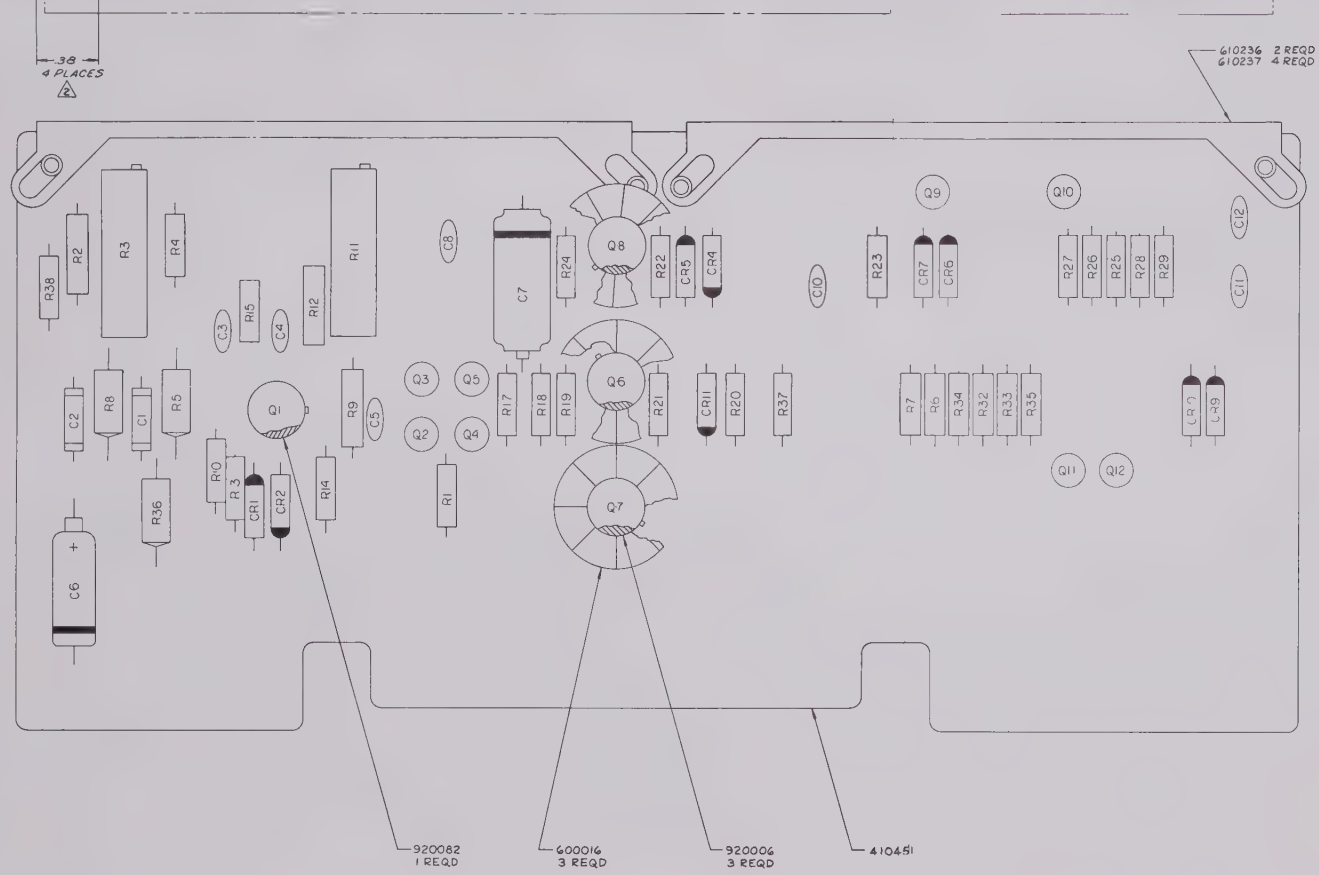
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC —
AUTO POLARITY

| SIZE | CODE IDENT NO. | DWG NO | |
|---|---|---|---|
| D | —— | 430415 | E |

SCALE —— WT —— SHEET 1 OF 1

AUTO POLARITY 402661 SERIAL Nº DANA




| REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|
| C1 | 120035 | 33PF | 2 |
| C2 | 120035 | 33PF | REF |
| C3 | 101145 | 100PF | 5 |
| C4 | 101145 | 100PF | REF |
| C5 | 101145 | 100PF | REF |
| C6 | 110038 | 5MFD 50V | 1 |
| C7 | 110036 | 25 MFD 50V | 1 |
| C8 | 101145 | 100PF | REF |
| C10 | 101145 | 100PF | REF |
| C11 | 101098 | 330 PF | 2 |
| C12 | 101098 | 330 PF | REF |
| CR1 | 211083 | D18 | 6 |
| CR2 | 211083 | D18 | REF |
| CR4 | 210013 | IN916 | 2 |
| CR5 | 210013 | IN916 | REF |
| CR6 | 211083 | D18 | REF |
| CR7 | 211083 | D18 | REF |
| CR9 | 211083 | D18 | REF |
| CR10 | 211083 | D18 | REF |
| CR11 | 221177 | 1 4 W2 4 A25 | 1 |
| Q1 | 200062 | D18 SELECTED | 1 |
| Q2 | 200043 | 2N3585 | 4 |
| Q3 | 200043 | 2N3585 | REF |
| Q4 | 200037 | 2N3646 | 4 |
| Q5 | 200037 | 2N3646 | 24 F |
| Q6 | 200011 | 009 | 1 |
| Q7 | 200035 | D14 | 2 |
| Q8 | 200035 | D14 | REF |
| Q9 | 200043 | 2N3585 | REF |
| Q10 | 200043 | 2N3585 | REF |
| Q11 | 200037 | 2N3648 | REF |
| Q12 | 200037 | 2N3648 | REF |
| R1 | 050202 | 2K | 1 |
| R2 | 010131 | 100 OHMS (1%) | 1 |
| R3 | 040050 | 5K (POT) | 1 |
| R4 | 000393 | 39K | 1 |
| R5 | 020186 | 10K (.05%) | 3 |
| R8 | 000243 | 24K | 2 |
| R7 | 000243 | 24K | REF |
| R6 | 020186 | 10K (.05%) | REF |
| R9 | 010038 | 422K (1%) | 2 |
| R10 | 000102 | 1K | 3 |
| R11 | 040054 | 50K (POT) | 1 |
| R12 | 010038 | 422K (1%) | REF |
| R13 | 000184 | 180K | 2 |
| R14 | 000184 | 180K | REF |
| R15 | 000102 | 1K | REF |
| R17 | 000102 | 1K | REF |
| R18 | 000472 | 4.7K | 2 |
| R19 | 000810 | 91 OHMS | 2 |
| R20 | 000472 | 4.7K | REF |
| R21 | 000810 | 91 OHMS | REF |
| R22 | 000103 | 10K | 1 |
| R23 | 000281 | 200 OHMS | 1 |
| R24 | 000470 | 47 OHMS | 1 |
| R25 | 000153 | 15K | 4 |
| R26 | 000103 | 10K | 1 |
| R27 | 000153 | 15K | REF |
| R28 | 000153 | 15K | REF |
| R29 | 000153 | 15K | REF |

| REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|
| R32 | 000103 | 10K | 2 |
| R33 | 000303 | 30K | 2 |
| R34 | 000103 | 10K | REF |
| R35 | 000353 | 30K | REF |
| R38 | 020186 | 10K (.05%) | REF |
| R37 | 000281 | 200 OHMS | 1 |
| R38 | 000213 | 27K | 1 |
| | 410451 | PCB-AUTO POLARITY | 1 |
| | 430756 | SCHEM AUTO POLAR | REF |
| | 60001F | HEAT SINK TERC | 3 |
| | 610238 | HANDLE EXTRACTOR | 2 |
| | 610237 | PIN SPRING | 4 |
| | 920006 | TRANS PAD LARGE | 3 |
| | 920010 | SOLDER 63 37 BAR | A R |
| | 920082 | TRANS PAD ROSS 10037 | 1 |

| QTY REQD | SYM | ITEM NO | GOVT OR VENDOR NO | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

4. SCHEMATIC REFERENCE. 430756
3. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.
2. HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO, LOCATED AS SHOWN.
1. ALL RESISTORS ARE 1/4W, 5% CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED

402013 010-1 1
400680 010 1 1

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ± .030, XX ± .010, XXX ± .005
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED 0.10 TIR
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO

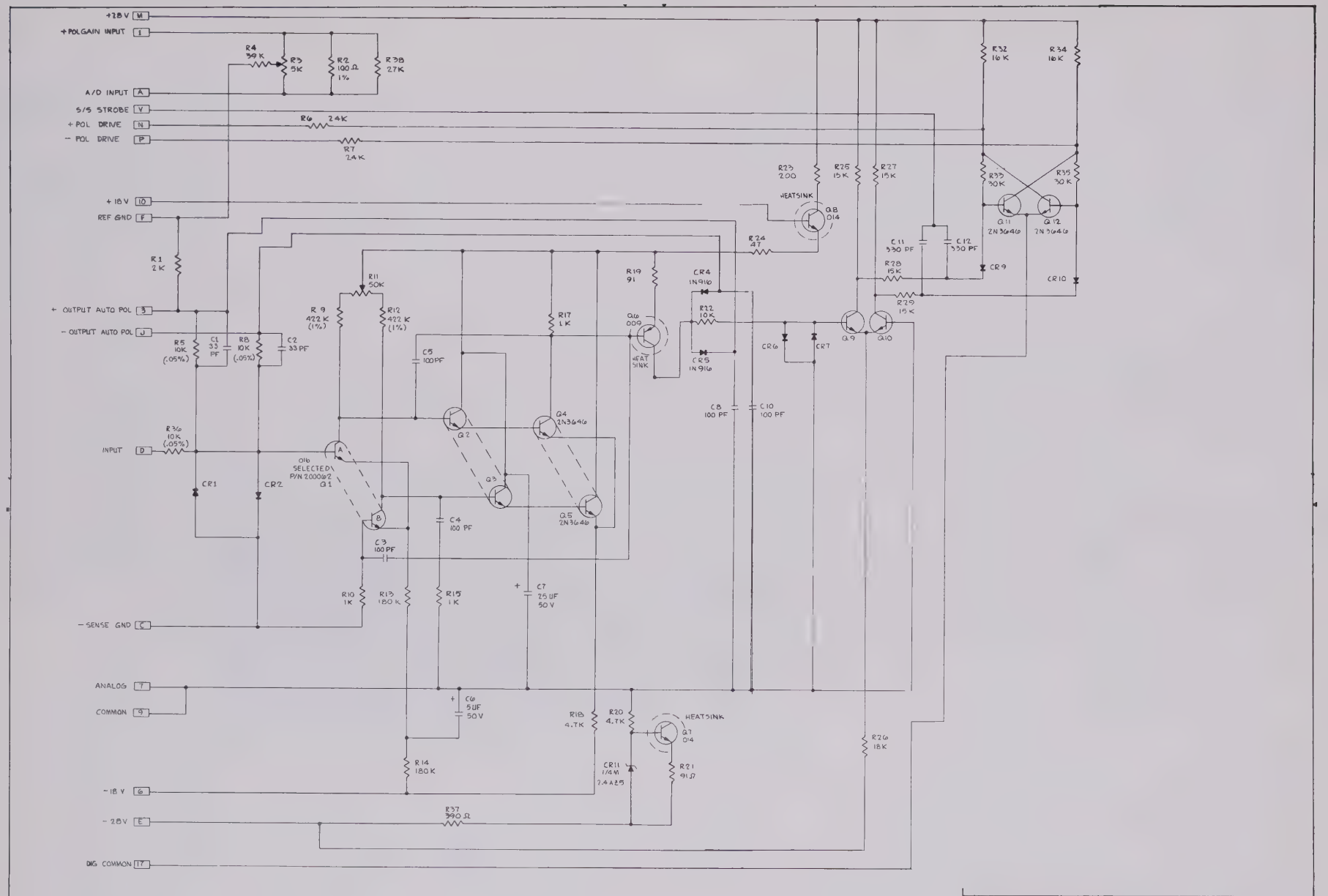
| | NAME | DATE |
|---|---|---|
| DR | R Whitty | 9 JAN 68 |
| CHK | Jeff | 10 JAN 68 |
| APPD | D. PAYNE | 3-12-68 |

3-22-68 REL
DRN 756

DANA LABORATORIES INC.
IRVINE CALIFORNIA

P.C. BOARD ASSY-
AUTO POLARITY

SIZE E | CODE IDENT NO 21793 | DWG NO 402661 | B
SCALE FULL | WT | SHEET 1 OF 1




5. HIGHEST NUMBERED REFERENCE DESIGNATORS: R 38 Q 12 C 12 CR 11
4. ALL VOLTAGES REFERENCED TO ANALOG COMMON
3. ALL TRANSISTORS 2N3565
2. ALL RESISTORS 1/4W, 5%, CARBON
1. ALL DIODES 018

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS X ± .030, XX ± .020, XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON TYE SAME AXIS SHALL NOT EXCEED .010 TIR
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO

| NAME | DATE |
|---|---|
| DR R. Stubbs | 3-28-68 |
| CHK T. H. | 3-28-68 |
| APPD D. Byrne | 3-12-68 |
| W. Stubbs 5-21 | |

DRN #756 3-28-68

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

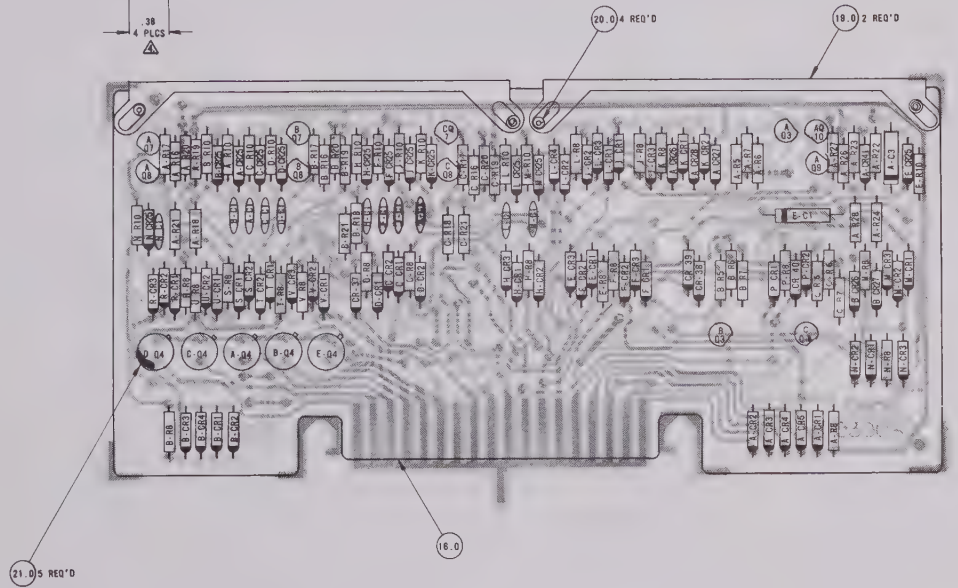
SCHEMATIC –
AUTO POLARITY

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| | 21793 | 430756 | A |

SCALE NONE WT SHEET 1 OF 1

402661 5400 REV R1

RANGE CONTROL 402197 SERIAL Nº DANA




| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| Q 11 | 13.0 | 2N3565 |
| Q 7 | 13.0 | 2N3565 |
| Q 4 | 12.0 | 014 |
| Q 3 | 13.0 | 2N3565 |
| CR41 | 15.0 | 018 |
| CR40 | 14.0 | SD4 |
| CR39 | 14.0 | SD4 |
| CR38 | 14.0 | SD4 |
| CR37 | 14.0 | SD4 |
| CR28 | 15.0 | 018 |
| CR27 | 15.0 | 018 |
| CR26 | 15.0 | 018 |
| CR25 | 15.0 | 018 |
| MCR3 | 14.0 | SD4 |
| PCR2 | 14.0 | SD4 |
| LCR2 | 14.0 | SD4 |
| KCR2 | 14.0 | SD4 |
| BCR2 | 14.0 | SD4 |
| ACR5 | 14.0 | SD4 |
| ACR1 | 14.0 | SD4 |
| CR 4 | 15.0 | 018 |
| CR 3 | 15.0 | 018 |
| CR 2 | 15.0 | 018 |
| CR 1 | 15.0 | 018 |
| C 3 | 11.0 | .0022 UF / 100V |
| E-C1 | 11.0 | 0022 UF / 100V |
| C 1 | 10.0 | 001 UF DISC |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| P-R8 | 9.0 | 8.2K |
| W-R8 | 9.0 | 8.2K |
| L-R8 | 9.0 | 8.2K |
| K-R8 | 9.0 | 8.2K |
| J-R8 | 9.0 | 8.2K |
| F-R8 | 8.0 | 5.1K |
| E-R8 | 8.0 | 5.1K |
| D-R8 | 2.0 | 12 K |
| C-R8 | 2.0 | 12 K |
| R 28 | 8.0 | 5.1K |
| R 27 | 3.0 | 15K |
| R 26 | 9.0 | 8.2K |
| R 24 | 1.0 | 100K |
| R 23 | 9.0 | 8.2K |
| R 22 | 6.0 | 24K |
| R 21 | 8.0 | 5.1K |
| R 20 | 3.0 | 15K |
| R 19 | 5.0 | 2.2K |
| R 18 | 8.0 | 5.1K |
| R 17 | 3.0 | 15K |
| R 16 | 5.0 | 2.2K |
| R 10 | 7.0 | 27K |
| R 8 | 6.0 | 24K |
| R 7 | 4.0 | 200K |
| R 6 | 3.0 | 15K |
| R 5 | 9.0 | 8.2K |

| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO | PART NO |
| 16.0 | 410300.6 |
| 19.0 | 610236 |
| 20.0 | 610237 |
| 21.0 | 920008 |

7. SCHEMATIC REFERENCE: 430501
6. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.
5. COMPONENTS WITH LETTER PREFIX ARE EXCEPTIONS TO STANDARD LOGIC.
4. HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO, LOCATED AS SHOWN.
3. ALL TRANSISTORS ARE 2N3565.
2. ALL DIODES ARE 018.
1. ALL RESISTORS ARE ½W, CARBON, 2%.

NOTES: UNLESS OTHERWISE SPECIFIED

LISTS WITH TOPFLIGHT

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| NEXT ASSY | USED ON | NA | FA |
|---|---|---|---|
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS .XX ±.030, .XXX ±.015 | ANGLES 0° 30' | FORMED ANGLES 1.0

MATERIAL

FINISH

CONTRACT NO.

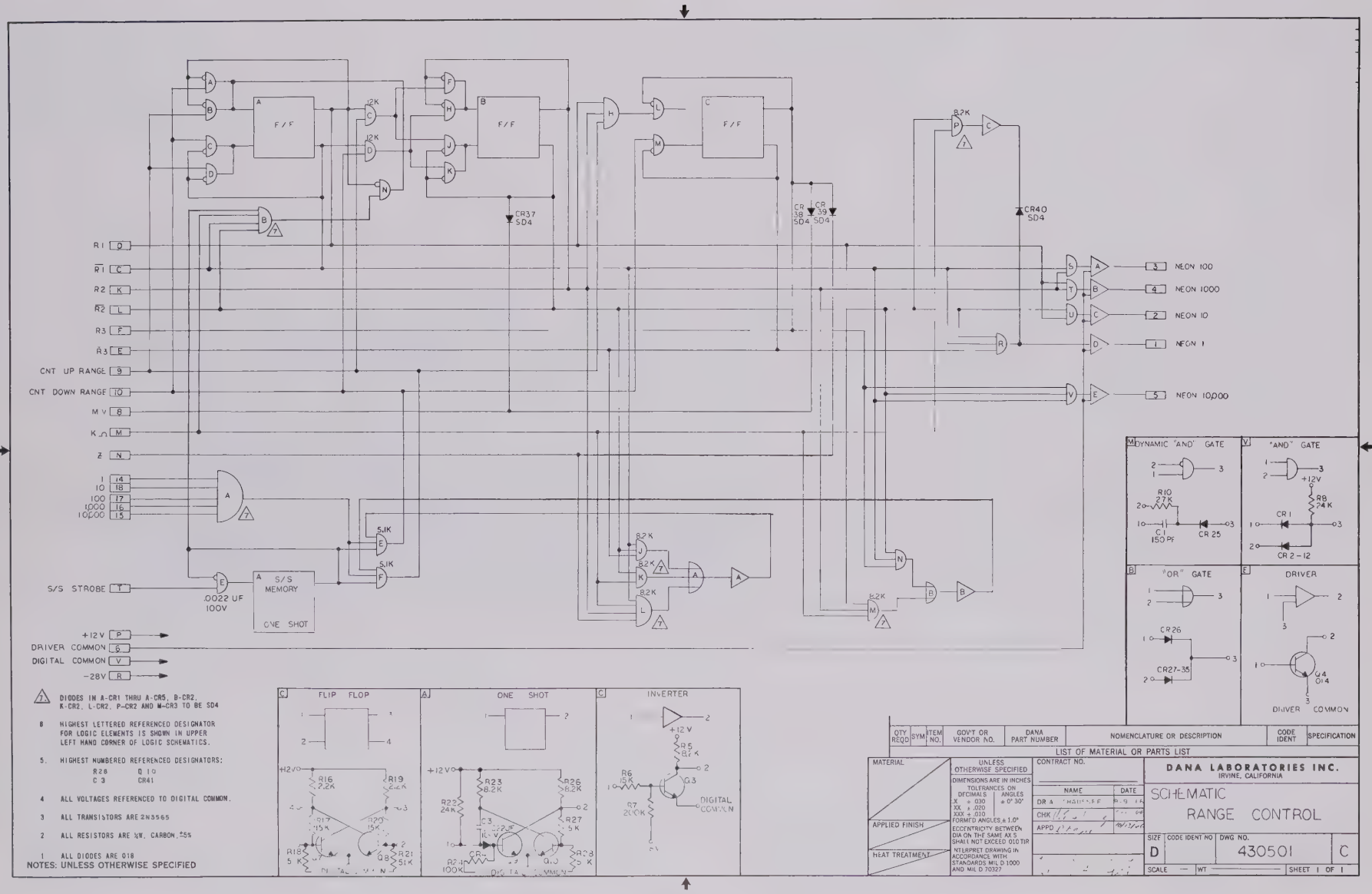
DRAWN A CHALSSEE 9-13-66
CHECK J.F. Salling 9-14-66
COG ENGR
PROJ ENGR D Payne 10/13/66

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

P.C. BOARD ASS'Y
RANGE CONTROL

| SIZE | CODE IDENT NO. | DWG NO. | REV |
|---|---|---|---|
| D | — | 402197 | E |

SCALE 2:1 | WT — | SHEET 1 OF 1




△7 DIODES IN A-CR1 THRU A-CR5, B-CR2, K-CR2, L-CR2, P-CR2 AND M-CR3 TO BE SD4

8 HIGHEST LETTERED REFERENCED DESIGNATOR FOR LOGIC ELEMENTS IS SHOWN IN UPPER LEFT HAND CORNER OF LOGIC SCHEMATICS.

5. HIGHEST NUMBERED REFERENCED DESIGNATORS:
R28 Q 10
C 3 CR41

4 ALL VOLTAGES REFERENCED TO DIGITAL COMMON.

3 ALL TRANSISTORS ARE 2N3565

2 ALL RESISTORS ARE ½W, CARBON, ±5%

1 ALL DIODES ARE 018

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: X ± .030, XX ± .020, XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AX S SHALL NOT EXCEED .010 TIR
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL D 1000 AND MIL D 70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | | |
| CHK | | |
| APPD | | |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC
RANGE CONTROL

| SIZE | CODE IDENT NO | DWG NO. | |
|---|---|---|---|
| D | | 430501 | C |

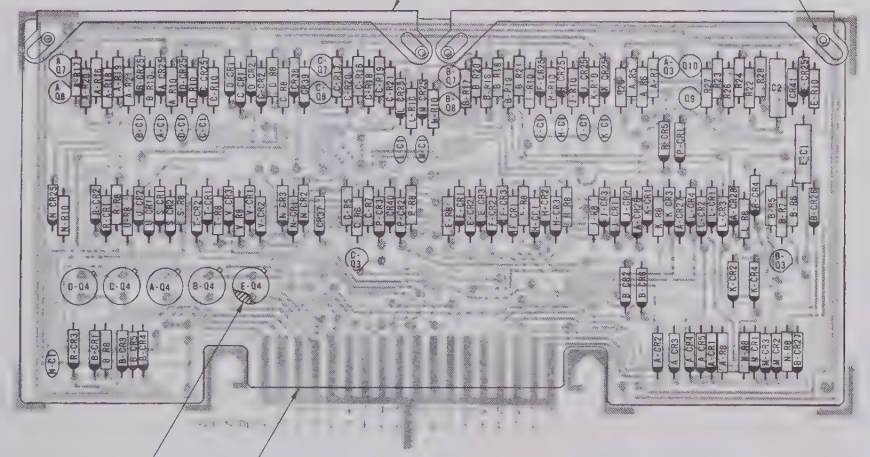
SCALE — WT — SHEET 1 OF 1

RANGE CONTROL 402382 SERIAL NO ..... DANA

.38
4 PLC'S

610236
2 REQ'D

610237
4 REQ'D




920006
5 REQ'D

410355 A

| REF DES | PART NO | DESCRIPTION |
|---|---|---|
| CR28 | 211083 | D18 |
| CR27 | " | " |
| CR26 | " | " |
| CR25 | 211083 | D18 |
| R-CR5 | 210004 | SD4 |
| A-CR5 | 210004 | SD4 |
| CR5 | 211083 | D18 |
| R-CR4 | " | SD4 |
| A-CR4 | 21[illegible] | SD4 |
| CR4 | 211083 | D18 |
| P-CR3 | 210004 | SD4 |
| L-CR3 | " | " |
| K-CR3 | " | " |
| B-CR3 | " | " |
| A-CR3 | 210004 | SD4 |
| CR3 | 211083 | D18 |
| P-CR2 | 210004 | SD4 |
| K-CR2 | " | " |
| B-CR2 | " | " |
| A-CR2 | 210004 | SD4 |
| CR2 | 211083 | D18 |
| P-CR1 | 210004 | SD4 |
| L-CR1 | " | " |
| A-CR1 | 210004 | SD4 |
| CR1 | 211083 | D18 |
| C2 | 121092 | .0022UF/100V |
| E-C1 | 121092 | .0022UF/100V |
| C1 | 101174 | .001UF DISC |

| REF DES | PART NO | DESCRIPTION |
|---|---|---|
| R10 | 000273 | 27 k |
| M-R8 | 000322 | 8.2 k |
| L-R8 | " | " |
| K-R8 | " | " |
| J-R8 | 000322 | 8.2 k |
| F-R8 | 000512 | 5.1 k |
| E-R8 | 000512 | 5.1 k |
| D-R8 | 000123 | 12 k |
| C-R8 | 000123 | 12 k |
| R8 | 000243 | 24 k |
| R7 | 000204 | 200 k |
| R6 | 000153 | 15 k |
| R5 | 000322 | 8.2 k |
| Q10 | 200043 | 2N3565 |
| Q9 | " | " |
| Q8 | " | " |
| Q7 | 200043 | 2N3565 |
| Q4 | 200035 | 014 |
| Q3 | 200043 | 2N3565 |
| CR41 | 211083 | D18 |
| CR40 | 210004 | SD4 |
| CR39 | " | " |
| CR38 | " | " |
| CR37 | 210004 | SD4 |

| REF DES | PART NO | DESCRIPTION |
|---|---|---|
| | | |
| R29 | 000322 | 8.2 k |
| R28 | 000512 | 5.1 k |
| R27 | 000153 | 15 k |
| R26 | 000322 | 8.2 k |
| R24 | 000104 | 100 k |
| R23 | 000322 | 8.2 k |
| R22 | 000243 | 24 k |
| R21 | 000512 | 5.1 k |
| R20 | 000153 | 15 k |
| R19 | 000222 | 2.2 k |
| R18 | 000512 | 5.1 k |
| R17 | 000153 | 15 k |
| R16 | 000222 | 2.2 k |

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|
| | | LIST OF MATERIAL OR PARTS LIST | | | |

| | | | |
|---|---|---|---|
| 402428 | 031 | 1 | 1 |
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS: .XX ±.030, .XXX ±.010
ANGLES: 0° 30'
FORMED ANGLES: 1.0

CONTRACT NO.

DRAWN R PRCHAL 3-29-61
CHECK [illegible] 3-31-61
COG. ENGR [illegible] 4-1-61
PROJ ENGR

MATERIAL

FINISH

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

P C BOARD ASSY-
RANGE CONTROL,031

SIZE D | CODE IDENT NO. ——— | DWG NO. 402382 | REV

SCALE 2 X | WT ——— | SHEET 1 OF 1

9. SCHEMATIC REFERENCE: 430608

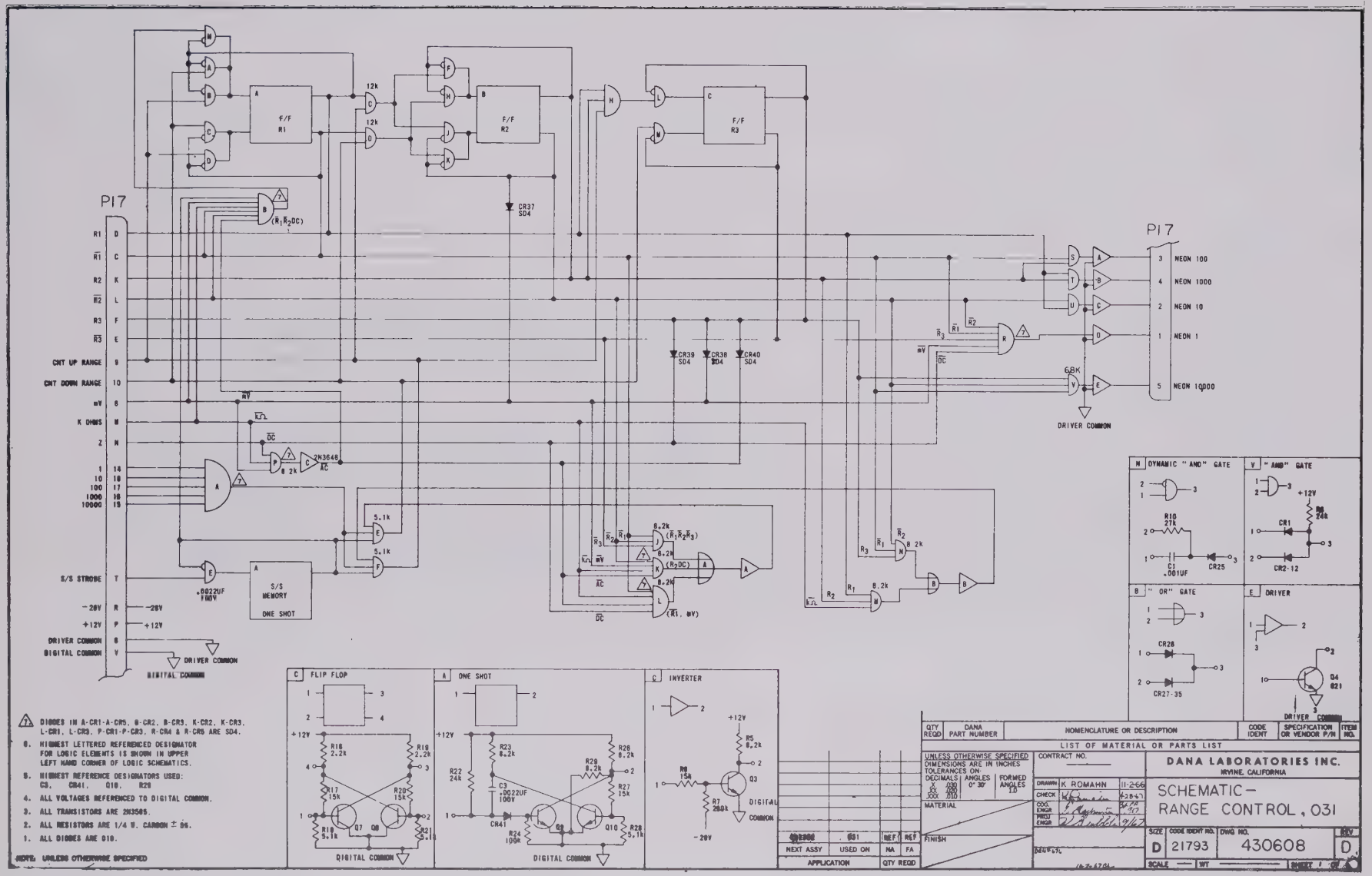
8. HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO, LOCATED AS SHOWN.

7. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.

2. ALL DIODES TO BE G18.

1. ALL RESISTORS TO BE 1/4W ± 5%, CARBON.

NOTE: UNLESS OTHERWISE SPECIFIED




⚠ DIODES IN A-CR1-A-CR5, B-CR2, B-CR3, K-CR2, K-CR3, L-CR1, L-CR3, P-CR1-P-CR3, R-CR4 & R-CR5 ARE SD4.

6. HIGHEST LETTERED REFERENCED DESIGNATOR FOR LOGIC ELEMENTS IS SHOWN IN UPPER LEFT HAND CORNER OF LOGIC SCHEMATICS.
5. HIGHEST REFERENCE DESIGNATORS USED: C3, CR41, Q10, R29
4. ALL VOLTAGES REFERENCED TO DIGITAL COMMON.
3. ALL TRANSISTORS ARE 2N3565.
2. ALL RESISTORS ARE 1/4 W. CARBON ± 5%.
1. ALL DIODES ARE 010.

NOTE: UNLESS OTHERWISE SPECIFIED

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON: DECIMALS .XX ±.02 .XXX ±.010; ANGLES 0° 30'; FORMED ANGLES ±1.0

MATERIAL

FINISH

CONTRACT NO.

| | | |
|---|---|---|
| DRAWN | K ROMAHN | 11-26-66 |
| CHECK | W. Romain | 12-8-66 |
| COG. ENGR | J. Patterson | 12-8-66 |
| PROJ ENGR | D. Randall | 12/8/66 |

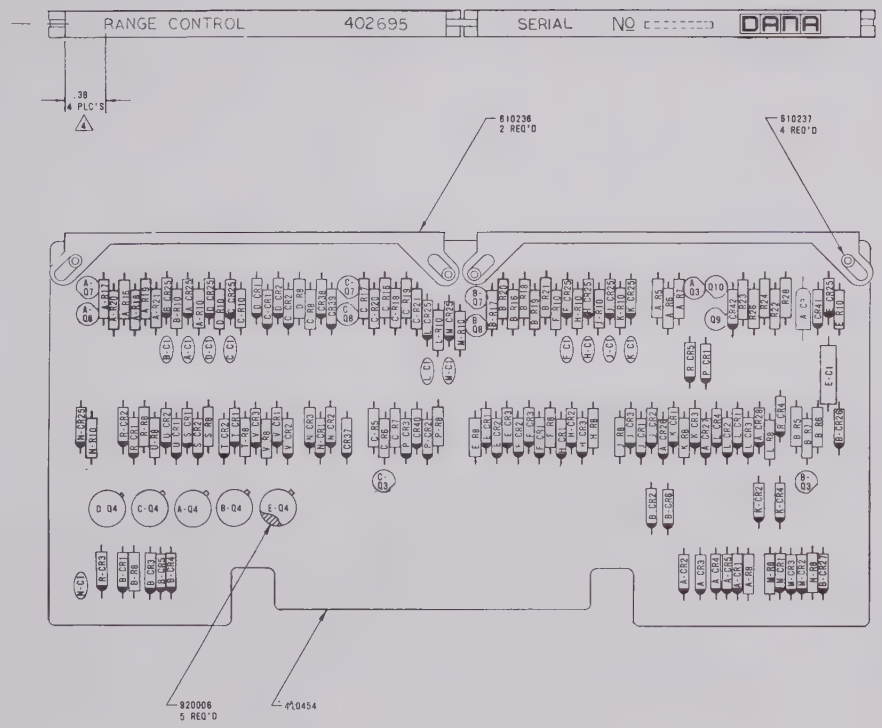
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC — RANGE CONTROL, 031

| SIZE | CODE IDENT NO. | DWG NO. | REV |
|---|---|---|---|
| D | 21793 | 430608 | D |

SCALE — WT — SHEET 1 OF 1

| NEXT ASSY | USED ON | REF | REF |
|---|---|---|---|
| | 031 | MA | FA |
| APPLICATION | | QTY REQD | |




| REF DES | PART NO | DESCRIPTION | QTY |
|---|---|---|---|
| CR28 | 211083 | 018 | REF |
| CR27 | 〃 | 〃 | 〃 |
| CR26 | 〃 | 〃 | 〃 |
| CR25 | 211083 | 018 | |
| | | | |
| CR8 | 211083 | 018 | |
| R-CR5 | 211083 | 018 | |
| A-CR5 | 210004 | SD4 | |
| CR5 | 211083 | 018 | |
| R-CR4 | 210004 | SD4 | |
| A-CR4 | 210004 | SD4 | |
| CR4 | 211083 | 018 | |
| P-CR3 | 210004 | SD4 | |
| L-CR3 | 211083 | 018 | |
| K-CR3 | 210004 | SD4 | |
| B-CR3 | 210004 | SD4 | |
| A-CR3 | 210004 | SD4 | |
| CR3 | 211083 | 018 | |
| P-CR2 | 210004 | SD4 | |
| K-CR2 | 〃 | 〃 | |
| B-CR2 | 〃 | 〃 | |
| A-CR2 | 210004 | SD4 | |
| CR2 | 211083 | 018 | |
| P-CR1 | 211083 | 018 | REF |
| L-CR1 | 211083 | 018 | |
| A-CR1 | 210004 | SD4 | 18 |
| CR1 | 211083 | 018 | 67 |
| | | | |
| | | | |
| C3 | 130053 | .68UF/35V | 1 |
| E-C1 | 121092 | .0022UF 100V | 1 |
| C1 | 101174 | .001UF DISC | 1 |

| REF DES | PART NO | DESCRIPTION | QTY |
|---|---|---|---|
| R10 | 000273 | 27 k | 1 |
| | | | |
| M-R8 | 000822 | 8.2 k | REF |
| L-R8 | 〃 | 〃 | 〃 |
| K-R8 | 〃 | 〃 | 〃 |
| J-R8 | 000822 | 8.2 k | 〃 |
| F-R8 | 000512 | 5.1 k | REF |
| E-R8 | 000512 | 5.1 k | 4 |
| D-R8 | 000123 | 12 k | REF |
| C-R8 | 000123 | 12 k | 2 |
| R8 | 000243 | 24 k | 1 |
| R7 | 000204 | 200 k | 1 |
| R6 | 000153 | 15 k | 4 |
| R5 | 000822 | 8.2 k | 8 |
| | | | |
| | | | |
| | | | |
| Q10 | 200037 | 2N3646 | REF |
| Q9 | 200043 | 2N3565 | 〃 |
| Q8 | 〃 | 〃 | 〃 |
| Q7 | 200043 | 2N3565 | REF |
| | | | |
| | | | |
| Q4 | 200035 | Q14 | 5 |
| Q3 | 200043 | 2N3565 | 4 |
| C-Q3 | 200037 | 2N3646 | 2 |
| | | | |
| CR42 | 220034 | 1N860B | 1 |
| CR41 | 211083 | 018 | REF |
| CR40 | 210004 | SD4 | 〃 |
| CR39 | 〃 | 〃 | 〃 |
| CR38 | 〃 | 〃 | 〃 |
| CR37 | 210004 | SD4 | REF |

| REF DES | PART NO | DESCRIPTION | QTY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| L-CR2 | 210004 | SD4 | REF |
| M-CR3 | 210004 | SD4 | REF |
| | | | |
| | | | |
| V-R8 | 000682 | 6.8k | 1 |
| | | | |
| P-R8 | 000822 | 8.2k | REF |
| M-R8 | 000822 | 8.2k | REF |
| | | | |
| | | | |
| R28 | 000104 | 100k | REF |
| | | | |
| R26 | 000202 | 2k | 1 |
| | | | |
| R24 | 000104 | 100 k | 2 |
| R23 | 000822 | 8.2 k | REF |
| R22 | 000153 | 15k | 〃 |
| R21 | 000512 | 5.1 k | |
| R20 | 000153 | 15 k | |
| R19 | 000222 | 2.2 k | |
| R18 | 000512 | 5.1 k | |
| R17 | 000153 | 15 k | REF |
| R16 | 000222 | 2.2 k | 2 |

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|
| | | LIST OF MATERIAL OR PARTS LIST | | | |
| 1 | 410454 | PCB-RANGE CONTROL | | | |
| REF | 430760 | SCHEMATIC-RANGE CONTROL | | | |
| 2 | 810236 | HANDLE-EXTRACTOR | | | |
| 4 | 810237 | PIN-SPRING | | | |
| 5 | 920006 | TRANS PAD-LARGE | | | |
| A/R | 920010 | SOLDER-BAR | | | |

| | | | |
|---|---|---|---|
| 402428 | D31 | 1 | 1 |
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS X .030 XX .020 XXX .010 | ANGLES 0° 30' | FORMED ANGLES 1.0

MATERIAL

FINISH

CONTRACT NO.

DRAWN 17 FEB 1960

CHECK 2/1/66

COG ENGR

PROJ ENGR 3/8

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

PC BOARD ASSY-
RANGE CONTROL

SIZE D | CODE IDENT NO. 21793 | DWG NO. 402695 | REV E

SCALE 2/1 | WT | SHEET 1 OF 1

5. SCHEMATIC REFERENCE: 430760

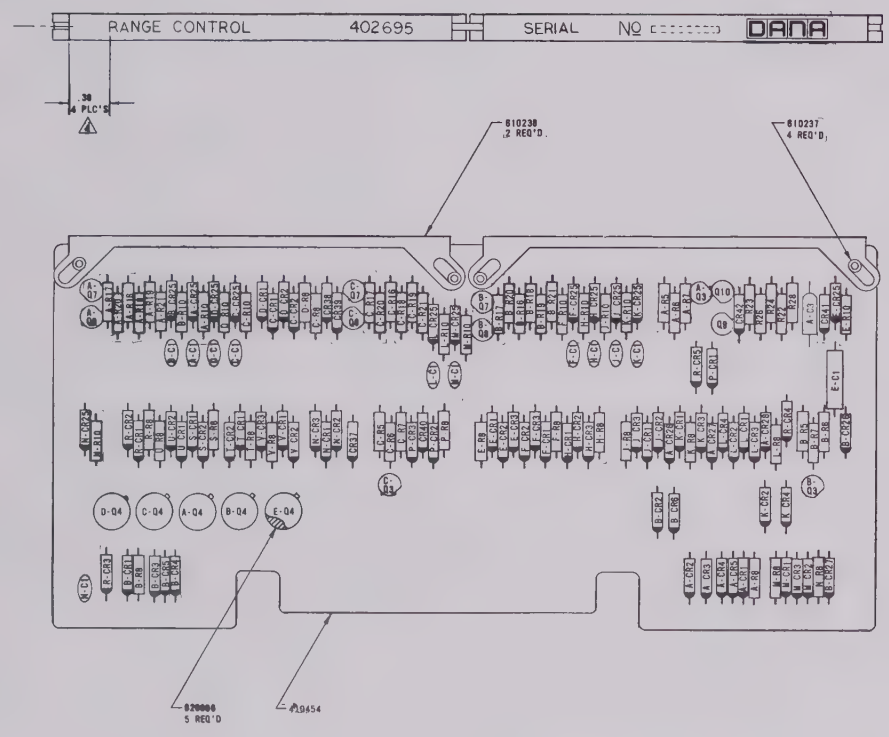
4. HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO. LOCATED AS SHOWN.

3. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.

2. ALL DIODES TO BE D1B.

1. ALL RESISTORS TO BE 1/4W ± 5%, CARBON.

NOTE: UNLESS OTHERWISE SPECIFIED




| REF DES OR ITEM | P N | DESCRIPTION | QTY |
|---|---|---|---|
| | 410454 | PCB-RANGE CONTROL | 1 |
| | 430760 | SCHEMATIC-RANGE CONTROL | REF |
| | 810236 | HANDLE-EXTRACTOR | 2 |
| | 810237 | PIN-SPRING | 4 |
| | 920008 | TRANS PAD-LARGE | 5 |
| | 920010 | SOLDER-BAR | A/R |

| REF DES | PART NO | DESCRIPTION | QTY |
|---|---|---|---|
| CR28 | 211083 | 018 | REF |
| CR27 | " | " | " |
| CR26 | " | " | " |
| CR25 | 211083 | 018 | |
| CR6 | 211083 | 018 | |
| R-CR5 | 211083 | 018 | |
| A-CR5 | 210004 | SD4 | |
| CR5 | 1083 | 018 | |
| R-CR4 | 210004 | SD4 | |
| A-CR4 | 210004 | SD4 | |
| CR4 | 211083 | 018 | |
| P-CR3 | 210004 | SD4 | |
| L-CR3 | 211083 | 018 | |
| K-CR3 | 210004 | SD4 | |
| B-CR3 | 210004 | SD4 | |
| A-CR3 | 210004 | SD4 | |
| CR3 | 211083 | 018 | |
| P-CR2 | 210004 | SD4 | |
| K-CR2 | " | " | |
| B-CR2 | " | " | |
| A-CR2 | 210004 | SD4 | |
| CR2 | 211083 | 018 | |
| P-CR1 | 211083 | 018 | REF |
| L-CR1 | 211083 | 018 | |
| A-CR1 | 210004 | SD4 | 18 |
| CR1 | 211083 | 018 | 67 |
| C3 | 110053 | .68UF/35V | 1 |
| E-C1 | 121092 | .0022UF/100V | 1 |
| C1 | 101174 | .001UF DISC | 1 |

| REF DES | PART NO | DESCRIPTION | QTY |
|---|---|---|---|
| R10 | 000273 | 27 k | 1 |
| W-R8 | 000822 | 8.2 k | REF |
| L-R8 | " | " | " |
| K-R8 | " | " | " |
| J-R8 | 000822 | 8.2 k | |
| F-R8 | 000512 | 5.1 k | REF |
| E-R8 | 000512 | 5.1 k | 4 |
| D-R8 | 000123 | 12 k | REF |
| C-R8 | 000123 | 12 k | 2 |
| R8 | 000243 | 24 k | 1 |
| R7 | 000204 | 200 k | 1 |
| R6 | 000153 | 15 k | 4 |
| R5 | 000822 | 8.2 k | 8 |
| Q10 | 200037 | 2N3646 | REF |
| Q9 | 200043 | 2N3585 | " |
| Q8 | " | " | " |
| Q7 | 200043 | 2N3585 | REF |
| Q4 | 200035 | 014 | 5 |
| Q3 | 200043 | 2N3585 | 4 |
| C-Q3 | 200037 | 2N3646 | 2 |
| CR42 | 229034 | 1N9608 | 1 |
| CR41 | 211083 | 018 | REF |
| CR40 | 210004 | SD4 | " |
| CR39 | " | " | " |
| CR38 | " | " | " |
| CR37 | 210004 | SD4 | REF |

| REF DES | PART NO | DESCRIPTION | QTY |
|---|---|---|---|
| L-CR2 | 210004 | SD4 | REF |
| M-CR3 | 210004 | SD4 | REF |
| Y-R8 | 000682 | 6.8k | 1 |
| P-R8 | 000822 | 8.2k | REF |
| N-R8 | 000822 | 8.2k | REF |
| R28 | 000104 | 100k | REF |
| R26 | 000202 | 2k | 1 |
| R24 | 000104 | 100 k | 2 |
| R23 | 000822 | 8.2 k | REF |
| R22 | 000153 | 15k | " |
| R21 | 000512 | 5.1 k | |
| R20 | 000153 | 15 k | |
| R19 | 000222 | 2.2 k | |
| R18 | 000512 | 5.1 k | |
| R17 | 000153 | 15 k | REF |
| R16 | 000222 | 2.2 k | 2 |

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|
| | | LIST OF MATERIAL OR PARTS LIST | | | |

| | | | |
|---|---|---|---|
| 402695 | 021 | 1 | 1 |
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS X .030, .XX .010, .XXX .010; ANGLES 0° 30'; FORMED ANGLES 1.0

MATERIAL

FINISH

CONTRACT NO.

DRAWN 12-1960

CHECK 9/1/60

ODG. ENGR

PROJ. ENGR 8/1

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# PC BOARD ASSY-RANGE CONTROL

| SIZE | CODE IDENT NO. | DWG NO. | REV |
|---|---|---|---|
| D | 21793 | 402695 | E |

SCALE 2/1 WT SHEET 1 OF 1

8. SCHEMATIC REFERENCE: 430760

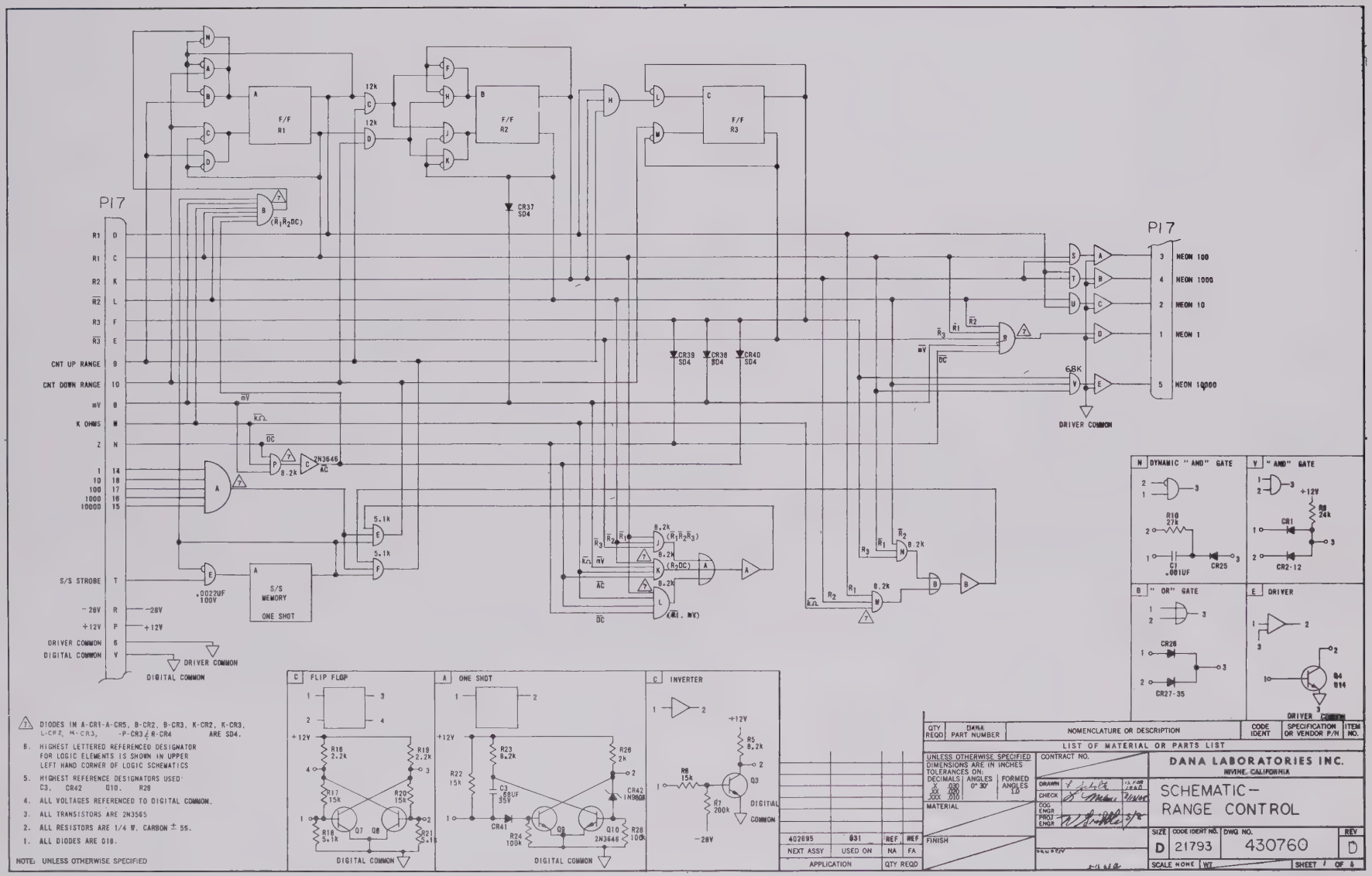
7. HEAT STAMP .18 HIGH BLACK CHARACTERS AND .15 HIGH LOGO, LOCATED AS SHOWN.

6. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS

2. ALL DIODES TO BE 018.

1. ALL RESISTORS TO BE 1/4W ± 5%, CARBON.

NOTE: UNLESS OTHERWISE SPECIFIED




⚠7 DIODES IN A-CR1-A-CR5, B-CR2, B-CR3, K-CR2, K-CR3, L-CR2, M-CR3, -P-CR3 & R-CR4 ARE SD4.

6. HIGHEST LETTERED REFERENCED DESIGNATOR FOR LOGIC ELEMENTS IS SHOWN IN UPPER LEFT HAND CORNER OF LOGIC SCHEMATICS
5. HIGHEST REFERENCE DESIGNATORS USED: C3, CR42 D10, R28
4. ALL VOLTAGES REFERENCED TO DIGITAL COMMON.
3. ALL TRANSISTORS ARE 2N3565
2. ALL RESISTORS ARE 1/4 W. CARBON ± 5%.
1. ALL DIODES ARE D18.

NOTE: UNLESS OTHERWISE SPECIFIED

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| 402695 | 031 | REF | REF |
|---|---|---|---|
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

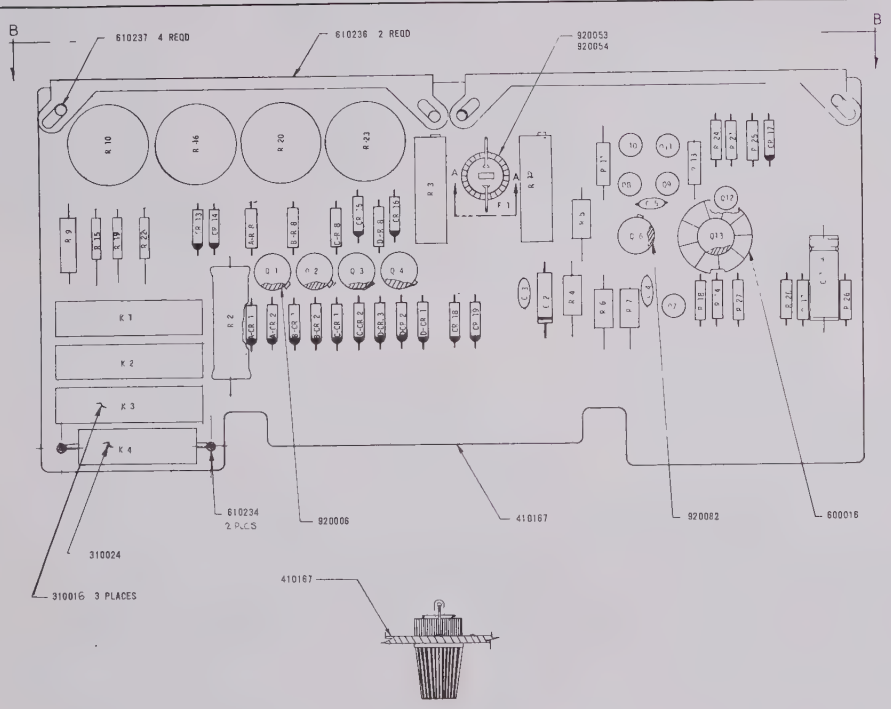
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON: DECIMALS .XX ±.030 .XXX ±.010; ANGLES 0° 30'; FORMED ANGLES 1.0
MATERIAL
FINISH
CONTRACT NO.

DRAWN 12 FEB 1968
CHECK
DOC ENGR
PROJ ENGR

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC — RANGE CONTROL

SIZE D | CODE IDENT NO. 21793 | DWG NO. 430760 | REV D
SCALE NONE | WT | SHEET 1 OF 6




SECTION A A

OHMS CONVERTER 400705 SERIAL Nº DANA

VIEW B-B

.38
4 PLCS

| REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|
| C1 | 110040 | 1 MFD 50 V | 1 |
| C2 | 121146 | 10047 MFD 100 V | 1 |
| C3 | 101174 | .001 MFD DISC | 2 |
| C4 | 101174 | .001 MFD DISC | REF |
| C5 | 101145 | 100PF | 1 |
| A-CR1 | 211083 | 018 | 13 |
| B-CR1 | 211083 | 018 | REF |
| C-CR1 | 211083 | 018 | REF |
| D-CR1 | 211083 | 018 | REF |
| A-CR2 | 211083 | 018 | REF |
| B-CR2 | 211083 | 018 | REF |
| C-CR2 | 211083 | 018 | REF |
| D-CR2 | 211083 | 018 | REF |
| D-CR3 | 211083 | 018 | REF |
| CR13 | 211083 | 018 | REF |
| CR14 | 211083 | 018 | REF |
| CR15 | 211083 | 018 | REF |
| CR16 | 211083 | 018 | REF |
| CR17 | 221177 | 1/4M2, 4A25 | 1 |
| CR18 | 210004 | SD4 | 2 |
| CR19 | 210004 | SD4 | REF |
| Q1 | 200035 | TRANSISTOR 014 | 4 |
| Q2 | 200035 | 014 | REF |
| Q3 | 200035 | 014 | REF |
| Q4 | 200035 | 014 | REF |
| Q6 | 200040 | 016 | 1 |
| Q7 | 200043 | 2N3565 | 6 |
| Q8 | 200043 | 2N3565 | REF |
| Q9 | 200043 | 2N3565 | REF |
| Q10 | 200043 | 2N3565 | REF |
| Q11 | 200043 | 2N3565 | REF |
| Q12 | 200043 | 2N3565 | REF |
| Q13 | 200011 | 009 | 1 |
| R2 | 010288 | 5 MEG 0.1% | 1 |
| R3 | 040054 | 50K POT | 1 |
| R4 | 020241 | 10K 0.05% | 1 |
| R5 | 020237 | 5,025K 0.05% | 2 |
| R6 | 020237 | 5,025K 0.05% | REF |
| R7 | 020241 | 10K 0.05% | REF |
| R8 | 000473 | 47K | 1 |
| R9 | 010289 | 555.5K 0.1% | 1 |
| R10 | 040053 | 5K POT | 1 |
| R11 | 010246 | 54.9K 1% | 2 |
| R12 | 040005 | 10K POT | 1 |
| R13 | 010246 | 54.9K 1% | REF |
| R14 | 000242 | 2.4K | 1 |
| R15 | 020238 | 50.5K 0.1% | 1 |
| R16 | 040062 | 500 POT | 1 |
| R17 | 000623 | 62K | 1 |
| R18 | 000152 | 1.5K | 1 |
| R19 | 020239 | 5,005K 1% | 1 |
| R20 | 040052 | 50 POT | 1 |
| R21 | 000202 | 2K | 1 |
| R22 | 020240 | 500 0.1% | 1 |
| R23 | 040051 | 5 POT | 1 |
| R24 | 000163 | 16K | 2 |
| R25 | 000163 | 16K | REF |
| R26 | 000101 | 100 | 1 |
| R27 | 000912 | 9.1K | 1 |
| R28 | 000100 | 10 | 1 |
| | 410167 | PC BOARD OHM CARD | 1 |
| | 420155 | PCB ARTWORK | REF |
| | 430303 | SCHEMATIC | REF |
| | 500004 | WIRE-22GA | A/R |
| | 600016 | HEAT SINK | 1 |
| | 610236 | HANDLE-EXTRACTOR | 2 |
| | 610237 | PIN-SPRING | 4 |
| | 920006 | TRANS PAD-LARGE | 5 |
| | 920053 | FUSEHOLDER | 1 |
| | 920054 | FUSE 0.1 AMP | 1 |
| | 920082 | TRANS PAD | 1 |
| | 610234 | TERMANEL | 2 |
| K1 | 310016 | RELAY SPST | 3 |
| K2 | 310016 | RELAY SPST | REF |
| K3 | 310016 | RELAY SPST | REF |
| K4 | 310024 | RELAY REED | 1 |

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| NEXT DWG | USED ON | NEXT ASSY | LAST ASSY |
|---|---|---|---|
| 5400 | | | |
| APPLICATION | | QTY REQD | |

MATERIAL
APPLIED FINISH
HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: X ±.030, XX ±.020, XXX ±.010; ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D 1000 AND MIL-D-70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | | 11-4-65 |
| CHK | MASCUCCI | 11-10-65 |
| APPD | | 11-10-65 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

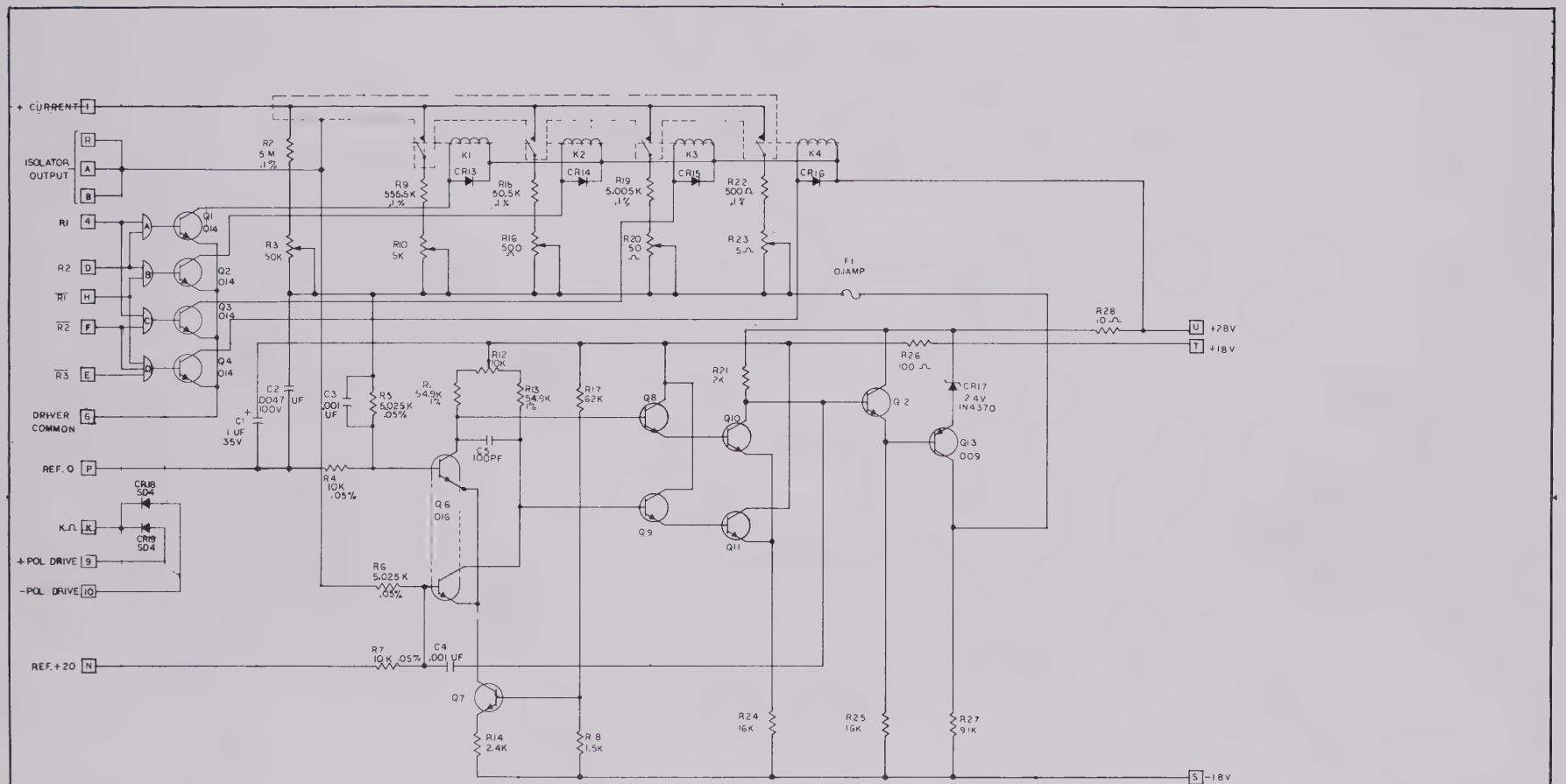
PC BOARD ASS'Y - OHMS CONVERTER

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | | 400705 | J |

SCALE 2:1 WT SHEET 1 OF 1

4. SCHEMATIC REF 430303
3. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.
2. Heat stamp .10 high black characters ' and .15 high logo, located as shown.
1. ALL RESISTORS ARE 1/4 W, ± 5%, CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED




6. Highest lettered reference designator for logic elements is shown in upper left hand corner of logic schematics
5. Highest numbered reference designators:
   R28 Q13
   C5 CR17
4. All voltages referenced to analog common
3. All transistors 2N3565
2. All resistors 1/4W, 5%, carbon
1. All diodes CR8

NOTES: UNLESS SPECIFIED OTHERWISE

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

D — "AND" GATE: inputs 1, 2; 3 to +28 V; R8 47 K; CR1; CR2-12

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS: .X ± .030, .XX ± .020, .XXX ± .010; ANGLES ± 0° 30'
FORMED ANGLES ± 1°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

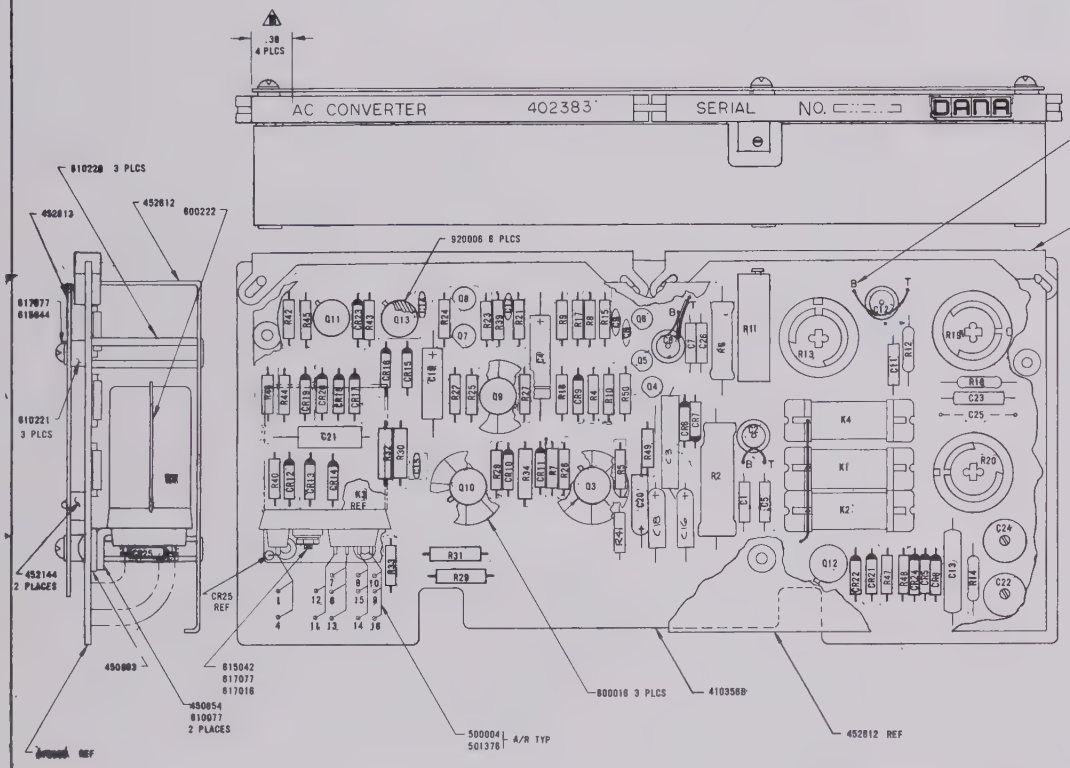
| NAME | DATE |
|---|---|
| DRA. CHAUSSEE | 9-22-65 |
| CHK | 9-28-65 |
| APPD | |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC - OHMS CONVERTER

SIZE D | CODE IDENT NO. — | DWG NO. 430303 D

SCALE — | WT — | SHEET 1 OF 4




| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CR8 | 211083 | 018 | Q8 | 200043 | 2N3565 | R27 | 000910 | 91 OHM | | | |
| CR7 | 211083 | 018 | Q7 | 200043 | 2N3565 | R28 | 000103 | 10k | | | |
| CR6 | 211083 | 018 | Q6 | 200043 | 2N3565 | R25 | 000432 | 4.3k | | | |
| CR5 | 211083 | 018 | Q5 | 200043 | 2N3565 | R24 | 000330 | 33 OHM | | | |
| | | | Q4 | 200068 | 2n4250 | R23 | 000751 | 750 OHM | | | |
| | | | Q3 | 200035 | 014 | R22 | 000330 | 33 OHM | | | |
| | | | | | | R21 | 000153 | 15k | | | |
| | | | | | | R20 | 040052 | 50 OHM | | | |
| C26 | 130042 | 2 7pf | | | | R19 | 040082 | 500 OHM | | | |
| C25 | | FSV NORMALLY NOT USED | | | | R18 | 010340 | 36.53k ±25% MATCH SET | | | |
| C24 | 130055 | 5-60pf | | | | R17 | 000392 | 3.9 k | | | |
| C23 | 130019 | 330pF/500V | K4 | | RELAY-REED 24V | R16 | 000201 | 200 OHM | R50 | 000104 | 100 k |
| C22 | 130055 | 5-60pf | K3 | | RELAY-4 POLE | R15 | 000152 | 1.5k | R49 | 000336 | 33M |
| C21 | 120089 | .38UF/100V | K2 | 310013 | RELAY-REED 24V | R14 | 010340 | 3.319k ±25% MATCH SET | R48 | 000308 | 300 k |
| C20 | 110001 | 6.8UF/20% 35V | K1 | 310013 | RELAY-REED 24V | R13 | 040053 | 5 k | R47 | 000243 | 24 k |
| C19 | 110002 | 22UF/20% 35V | | | | R12 | 010340 | 365K ±25% MATCH SET | R46 | 000243 | 24 k |
| C18 | 110001 | 6.8UF/20% 35V | | | | R11 | 040054 | 50k | R45 | 000473 | 47 k |
| C17 | 100005 | 22pF 10% DISC | CR25 | 211083 | 018 | R10 | 000201 | 200 OHM | R44 | 000304 | 300 k |
| C16 | 110001 | 6.8UF/20% 35V | CR24 | | | R9 | 000272 | 2.7k | R43 | 000243 | 24 k |
| C15 | 101641 | 470pF DISC | CR23 | | | R8 | 000882 | 8.8k | R42 | 000243 | 24 k |
| C14 | 100008 | 10pF DISC | CR22 | | | R7 | 000470 | 47 OHM | R41 | 000243 | 24 k |
| C13 | 130048 | 3900pF | CR21 | | | R6 | 010340 | 3.28 M MATCH SET | R40 | 000243 | 24 k |
| C12 | 130029 | 1-5pF | CR20 | | | R5 | 000101 | 100 OHM | R39 | 000152 | 1.5 k |
| C11 | 130059 | 80 pF | CR19 | | | R4 | 000883 | 68k | | | |
| | | | CR18 | | | | | | | | |
| C9 | 100008 | 10pF DISC | CR17 | | | R2 | 010340 | 1 M ±.1% MATCH SET | | | |
| C8 | 130029 | 1-5pF | CR16 | | | | | | | | |
| C7 | 130042 | 2.7 pF | CR15 | 211083 | 018 | | | | R34 | 001705 | 820 OHM 1/2W 5% |
| C6 | 101641 | 470pF DISC | CR14 | 210004 | SD4 | | | | R33 | 000202 | 2 k |
| C5 | 130047 | 33pF | CR13 | 210004 | SD4 | Q13 | 200035 | 014 | R32 | 020184 | 135 k ±1% |
| C4 | 110038 | 50UF/15V | CR12 | 210004 | SD4 | Q12 | 200035 | 014 | R31 | 020184 | 135 k ±1% |
| C3 | 120055 | 1/4uf 100V | CR11 | 211083 | 018 | Q11 | 200035 | 014 | R30 | 020185 | 270 k ±1% |
| C2 | 130029 | 1-5pF | CR10 | 211083 | 018 | Q10 | 200035 | 014 | R29 | 020185 | 270 k ±1% |
| C1 | 130027 | 10pF 10% | CR9 | 220004 | 1N961B | Q9 | 200011 | 009 | R28 | 000390 | 39 OHM |
| REF DES | PART NO. | DESCRIPTION | REF DES | PART NO. | DESCRIPTION | REF DES | PART NO. | DESCRIPTION | REF DES | PART NO. | DESCRIPTION |

| REF DES OR ITEM | P/N | DESCRIPTION | QTY | REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|---|---|---|---|
| | 410356 | PCB-AC CONVERTER | 1 | | 810221 | SPACER-STD 1/4 D X 1/8 LG CTC #1247-1 | 3 |
| | 430809 | SCHEM-AC CONVERTOR | A/R | | | | |
| | 450854 | BRACKET RELAY MTG | 1 | | 810238 | HANDLE-EXTRACTOR | 2 |
| | 450963 | SPACE-RELAY BRKT | 1 | | 810237 | PIN-SPRING | 4 |
| | 452144 | INSULATOR-STANDOFF | 8 | | 815042 | SCREW PPH 4-40 X 1/4 | 1 |
| | 452812 | PLATE-SHIELD,FRONT | 1 | | | | |
| | 452813 | PLATE-SHIELD,REAR | 1 | | 815044 | SCREW PPH 4-40 X 3/8 | 3 |
| | 500004 | WIRE-BUSS | A/R | | 817016 | HEX NUT-4-40 RADIO | 1 |
| | 501378 | TUBING-20GA TEF | A/R | | 817077 | WASHER INT LOCK #4 | 4 |
| | | | | | 920006 | WASHER PRS-LARGE | 6 |
| | 800018 | HEAT SINK | 3 | | 920010 | SOLDER-63/37 BAR | A/R |
| | 800222 | SOCKET-RELAY, 4 POLE | 1 | | 920028 | SOLDER-WIRE | A/R |
| | 810077 | RIVET 1/8 DIA X 1/4 LG SEMI TUBL | 2 | | | | |
| | 810220 | STDOFF-STD #4-40 X 1/4 | 3 | | | | |

4. SCHEMATIC REFERENCE: 430809.
2. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS
3. HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO, LOCATED AS SHOWN.
1. ALL RESISTORS ARE 1/4 W, ± 5%, CARBON

NOTE: UNLESS OTHERWISE SPECIFIED

| SALES ORDER | MODEL 29 | — | — |
|---|---|---|---|
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS ANGLES .XX ±.030 .XXX ±.010 FORMED ANGLES 0° 30' 1.0

CONTRACT NO.

MATERIAL

FINISH

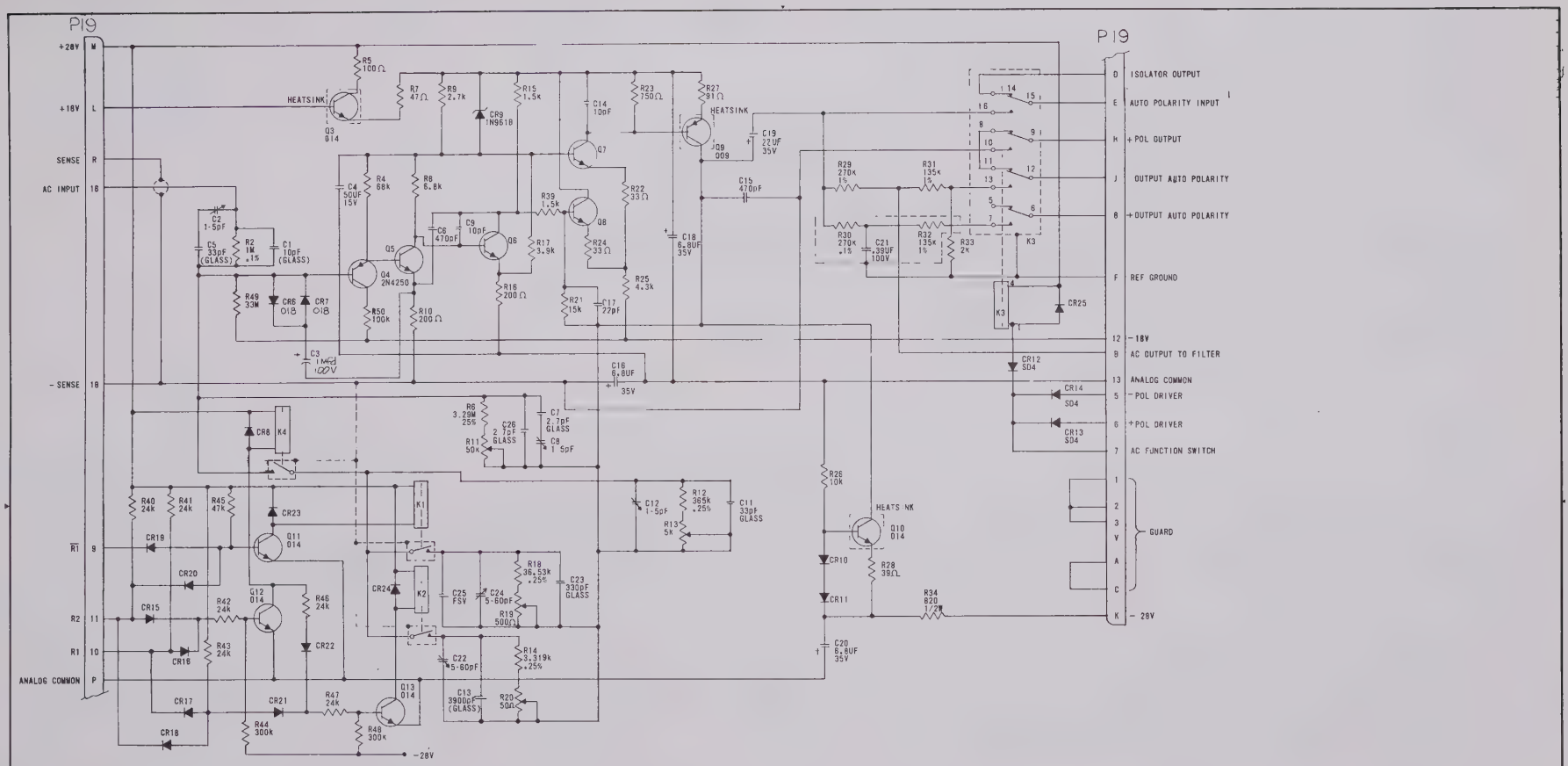
DRAWN G SOLOVIEFF 1-20-67
CHECK KW Romahn 1-30-67
COG ENGR
PROJ ENGR

DANA LABORATORIES INC.
IRVINE CALIFORNIA

P.C. BOARD ASSY-
AC CONVERTER, MOD29

| SIZE | CODE IDENT NO. | DWG NO. | REV |
|---|---|---|---|
| D | 21793 | 402383 | K |

SCALE 2/1 WT ——— SHEET 1 OF 1




8. REFERENCE DESIGNATORS NOT USED: C10; CR1-CR5; Q1, Q2; R1, R3, R35-R38
5. HIGHEST NUMBERED REFERENCE DESIGNATORS USED: C25, CR25, K4, Q13, R50
4. ALL VOLTAGES REFERENCED TO ANALOG COMMON.
3. ALL TRANSISTORS ARE 2N3565.
2. ALL RESISTORS ARE 1/4W, ± 5%, CARBON.
1. ALL DIODES ARE 018.

NOTE: UNLESS OTHERWISE SPECIFIED

| QTY REQD | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION OR VENDOR P/N | ITEM NO. |
|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| | | | |
|---|---|---|---|
| 402383 | MODEL 29 | REF | REF |
| NEXT ASSY | USED ON | NA | FA |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS X .030 .XX .010 .XXX .005; ANGLES 0° 30'; FORMED ANGLES 1.0

MATERIAL

FINISH

CONTRACT NO.

DRAWN R PACHAL 4-1-67

CHECK M Romeiko 4-24-67

COG. ENGR

PROJ ENGR

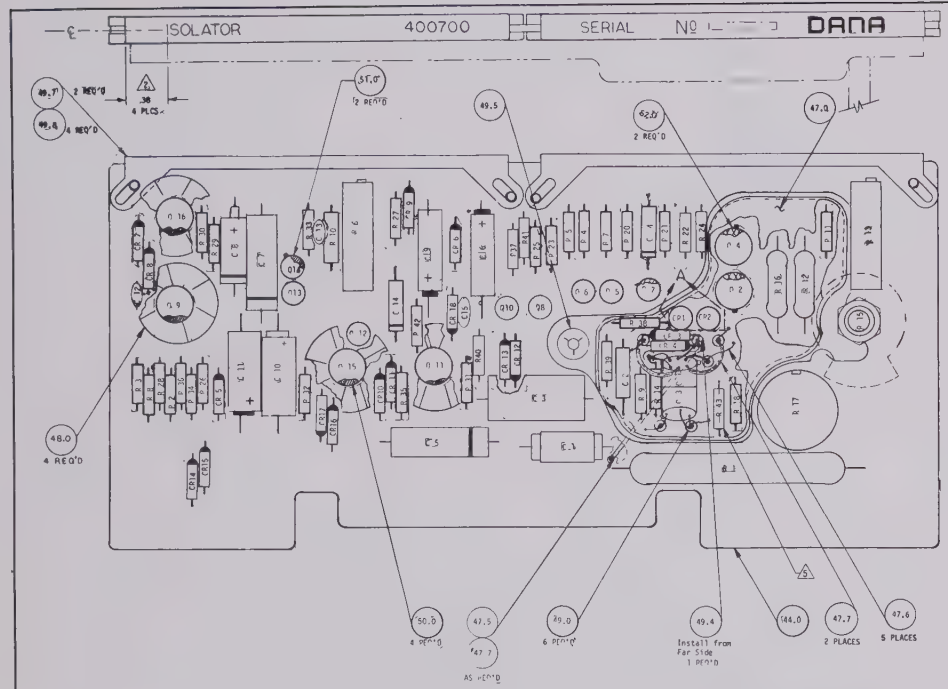
DANGLE

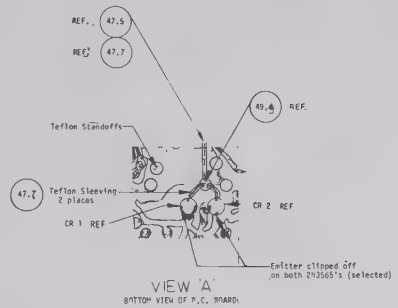
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC - A C CONVERTER, MOD29

| SIZE | CODE IDENT NO. | DWG NO. | REV. |
|---|---|---|---|
| D | 21793 | 430609 | D |

SCALE NONE WT SHEET 1 OF 2




| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO | PART NO |
| 44.0 | 410104-9 |
| 47.0 | 410079 |
| 47.3 | 500604 |
| 47.6 | 500037 |
| 47.7 | 501376 |
| 48.0 | 600016 |
| 49.0 | 600030 |
| 49.4 | 600243 |
| 49.5 | 610087 |
| 49.7 | 610236 |
| 49.8 | 610237 |
| 50.0 | 920006 |
| 51.0 | 920007 |
| 52.0 | 920082 |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| CR19 | 43.5 | 1/4W2.4AZ10 |
| CR17 | 41.0 | SD4 |
| CR16 | 41.0 | SD4 |
| CR15 | 42.0 | 018 |
| ↓ | ↓ | ↓ |
| CR10 | 42.0 | 018 |
| 9 | 43.0 | 1N958B |
| CR8 | 0 | 018 |
| CR7 | 42.0 | 018 |
| CR6 | 43.0 | 1N958B |
| CR5 | 42.0 | 018 |
| CR4 | 42.3 | 007 |
| CR3 | 42.3 | 007 |
| CR2 | 39.5 | 200048 |
| CR1 | 39.5 | 200048 |
| C15 | 25.7 | 100 PF |
| C14 | 31.0 | .01UF/100V |
| C13 | 25.7 | 100PF DISC |
| C12 | 25.5 | 15PF DISC |
| C11 | 26.0 | 25UF 50V |
| C10 | 26.0 | 25UF 50V |
| C9 | 27.0 | 50UF 12/15V |
| C8 | 28.0 | 5UF 50V |
| C7 | 29.0 | 1UF 100V |
| C6 | 27.0 | 50UF 12/15V |
| C5 | 29.0 | .1UF 100V |
| C4 | 31.0 | .001UF 100V |
| C3 | 30.0 | 2.0UF 100V |
| C2 | 32.0 | .0047UF 100V |
| C1 | 30.5 | 750 PF 500V |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| R34 | 12.8 | 510 OHMS |
| R33 | 9.7 | 3.3K |
| R32 | 13.0 | 51K |
| R31 | 4.0 | 1.2K |
| R30 | 17.0 | 75 OHMS |
| R29 | 9.3 | 24 OHMS |
| R28 | 20.0 | 9.1K |
| R27 | 20.0 | 9.1K |
| R26 | 8.0 | 15K |
| R25 | 11.0 | 43K |
| R24 | 2.0 | 1K |
| R23 | 10.0 | 3.3 MEG |
| R22 | 10.5 | 39K |
| R21 | 20.0 | 9.1K |
| R20 | 2.0 | 1K |
| R18 | 18.0 | 7.5K |
| R17 | 23.0 | 5K POT |
| R16 | 21.0 | 4.99 MEG,1% |
| R15 | 24.0 | 250K POT |
| R14 | 10.0 | 3.3 MEG |
| R13 | 25.0 | 500K POT |
| R12 | 21.0 | 4.99 MEG,1% |
| R11 | 5.0 | 120K |
| P10 | 22.2 | 49.9 OHMS, 1% |
| R9 | 9.5 | 2.4K |
| R8 | 1.0 | 100 OHMS |
| R7 | 4.0 | 1.2K |
| R6 | 22.8 | 5K POT |
| R5 | 18.0 | 6.2K |
| R4 | 4.0 | 1.2K |
| R3 | 1.0 | 100 OHMS |
| R2 | 16.1 | 62K |
| R1 | 22.0 | 25 MEG,1% |

| REF DES | B/M ITEM | DESCRIPTION |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Q18 | 35.0 | 014 |
| Q15 | 35.0 | 014 |
| Q14 | 33.8 | 012 |
| Q13 | 39.0 | 2N3565 |
| Q12 | 39.0 | 2N3565 |
| Q11 | 33.0 | 008 |
| Q10 | 39.0 | 2N3565 |
| Q9 | 35.0 | 014 |
| Q8 | 39.0 | 2N3565 |
| Q7 | 33.8 | 012 |
| Q5 | 39.1 | 200044 MATCHED PAIR |
| | 39.1 | 200044 |
| Q4 | 39.8 | 200063 SELECTED 018 |
| Q3 | 40.0 | 2N1304 |
| Q2 | 39.8 | 200063 SELECTED 018 |
| Q1 | 38.0 | 015 |
| | | |
| | | |
| R43 | 20.5 | FSV |
| R42 | 1.0 | 100 OHMS |
| R41 | 11.5 | 4.7K |
| R40 | 8.0 | 15 h |
| R39 | 5.3 | 1.3K |
| R38 | 5.5 | 13 MEG |
| R37 | 15.0 | 5.8 MEG |
| R36 | 8.3 | 24 OHMS |
| R35 | 1.0 | 100 OHMS |

⚠5 INSTALL A 75 OHM 1/4W CARBON RESISTOR (P/N 000750) INITIAL ASSEMBLY

4. SCHEMATIC REFERENCE: 430205

3. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM TO DANA WORKMANSHIP STANDARDS

⚠2 HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO. LOCATED AS SHOWN

1. ALL RESISTORS TO BE 1/4 W, ± 5%, CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DEC MAL'S ± .030
.X ± .020
.XX ± .010
.XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

| | NAME | DATE |
|---|---|---|
| DR | | 10-26-65 |
| CHK | | 10-27-65 |
| APPD | | |

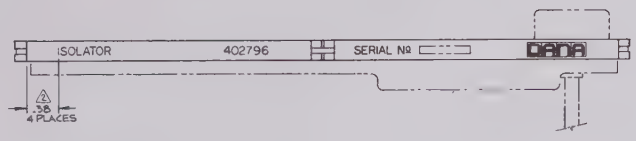
10-20-65
DRAWING RELEASED

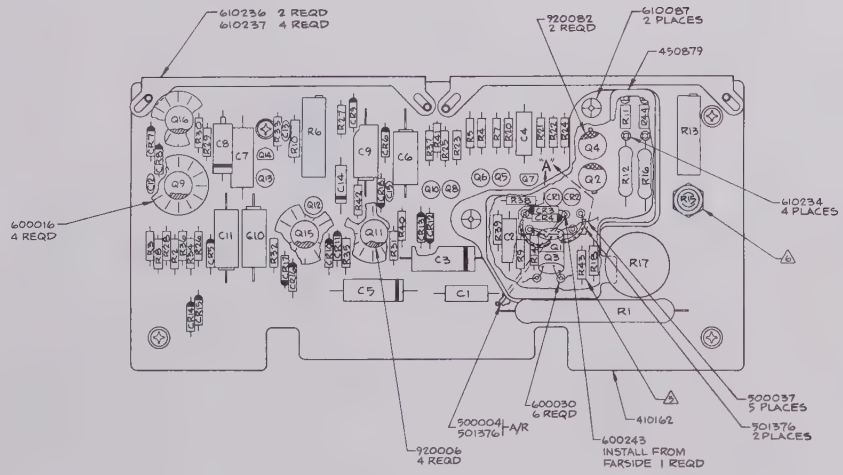
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

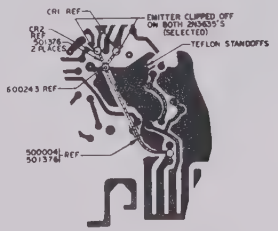
P C BOARD ASS'Y - ISOLATOR

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| D | 21793 | 400700 | X |

SCALE 2:1 | WT | SHEET 1 OF 2




DETAIL "A"
(FARSIDE)

⚠ SOLDER LEADS OF R15 (250K POT) ON BOTH SIDES OF P.W. BOARD.

⚠ INSTALL A 750HM 1/4W CARBON RESISTOR (P/N 000750) INITIAL ASSEMBLY.

4. SCHEMATIC REFERENCE: 430305

5. ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS.

⚠ HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO, LOCATED AS SHOWN.

1. ALL RESISTORS 1/4W, ± 5%, CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED

| REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|
| CR18 | 220012 | 1AM2 4AZ10 | |
| CR17 | 210004 | SD4 | |
| CR16 | 210004 | SD4 | |
| CR15 | 211083 | 018 | |
| CR14 | | | |
| CR13 | | | |
| CR12 | | | |
| CR11 | | | |
| CR10 | 211083 | 018 | |
| CR9 | 220012 | 1N958B | |
| CR8 | 211083 | 018 | |
| CR7 | 211083 | 018 | |
| CR6 | 220012 | 1N958B | |
| CR5 | 211083 | 018 | |
| CR4 | 211236 | 007 | |
| CR3 | 211236 | 007 | |
| CR2 | 200048 | 2N3565 | |
| CR1 | 200048 | 2N3565 | |
| C15 | 101145 | 100pF DISC | |
| C14 | 121008 | .01UF/100V | |
| C13 | 101145 | 100pF/DISC | |
| C12 | 100013 | 15pF/DISC | |
| C11 | 110036 | 25UF/50V | |
| C10 | 110036 | 25UF/50V | |
| C9 | 110038 | 50UF 12/15V | |
| C8 | 110039 | 5UF/50V | |
| C7 | 120003 | .1UF 100V | |
| C6 | 110038 | 50UF 12/15V | |
| C5 | 120003 | .1UF 100V | |
| C4 | 120005 | .001UF 100V | |
| C3 | 120063 | 2.0UF 100V | |
| C2 | 121146 | .0047UF/100V | |
| C1 | 120108 | 750pF/500V | |
| R16 | 011178 | 4.99 MEG 1% | |
| R15 | 040052 | 250K POT | |
| R14 | 000335 | 3.3 MEG | |
| R13 | 040055 | 50Ck POT | |
| R12 | 011178 | 4.99 MEG 1% | |
| R11 | 001737 | FSV | |
| R10 | 010308 | 49.9 OHMS 1% | |
| R9 | 000242 | 2.4k | |
| R8 | 000101 | 100 OHMS | |
| R7 | 000122 | 1.2k | |
| R6 | 040050 | 5k POT | |
| R5 | 000622 | 6.2k | |
| R4 | 000122 | 1.2k | |
| R3 | 000101 | 100 OHMS | |
| R2 | 000623 | 62k | |
| R1 | 010249 | 25 MEG 1% | |
| Q16 | 200035 | 014 | |
| Q15 | 200035 | 014 | |
| Q14 | 200022 | 012 | |
| Q13 | 200043 | 2N3565 | |
| Q12 | 200043 | 2N3565 | |
| Q11 | 200011 | 889 | |
| Q10 | 200043 | 2N3565 | |
| Q9 | 200035 | 014 | |
| Q8 | 200043 | 2N3565 | |
| Q7 | 200022 | 012 | |
| Q6 | 200044 | MATCHED PAIR | |
| Q5 | | | |
| Q4 | 200043 | SELECTED 016 | |
| Q3 | 251084 | 2N1304 | |
| Q2 | 200063 | SELECTED 016 | |
| Q1 | 200027 | 015 | |
| R44 | 001737 | FSV | |
| R43 | 001737 | FSV | |
| R42 | 000101 | 100 OHMS | |
| R41 | 000472 | 4.7k | |
| R40 | 000153 | 15K | |
| R39 | 000132 | 1.3K | |
| R38 | 000136 | 13 MEG | |
| R37 | 000565 | 5.6 MEG | |
| R36 | 000240 | 24 OHMS | |
| R35 | 000101 | 100 OHMS | |
| R34 | 000511 | 510 OHMS | |
| R33 | 000332 | 3.3K | |
| R32 | 000313 | 51K | |
| R31 | 000122 | 1.2K | |
| R30 | 000750 | 75 OHMS | |
| R29 | 000240 | 24 OHMS | |
| R28 | 000912 | 9.1K | |
| R27 | 000912 | 9.1K | |
| R26 | 000153 | 15K | |
| R25 | 000433 | 43K | |
| R24 | 000102 | 1K | |
| R23 | 000335 | 3.3 MEG | |
| R22 | 000393 | 39K | |
| R21 | 000912 | 9.1K | |
| R20 | 000102 | 1K | |
| R18 | 000752 | 7.5K | |
| R17 | 040053 | 5K POT | |

| QTY REQD | SYM | ITEM NO | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| | | | |
|---|---|---|---|
| 400080 | 010 | 1 | AR |
| NEXT DWG. | USED ON | QTY. PER | UNIT |
| APPLICATION | | QTY REQD | |

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DEC MAL'S ANGLES
X ± .030 ± 0° 30'
.XX ± .010
.XXX ± .005
FORMED ANGLES ± 1.0°
EXCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED 010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

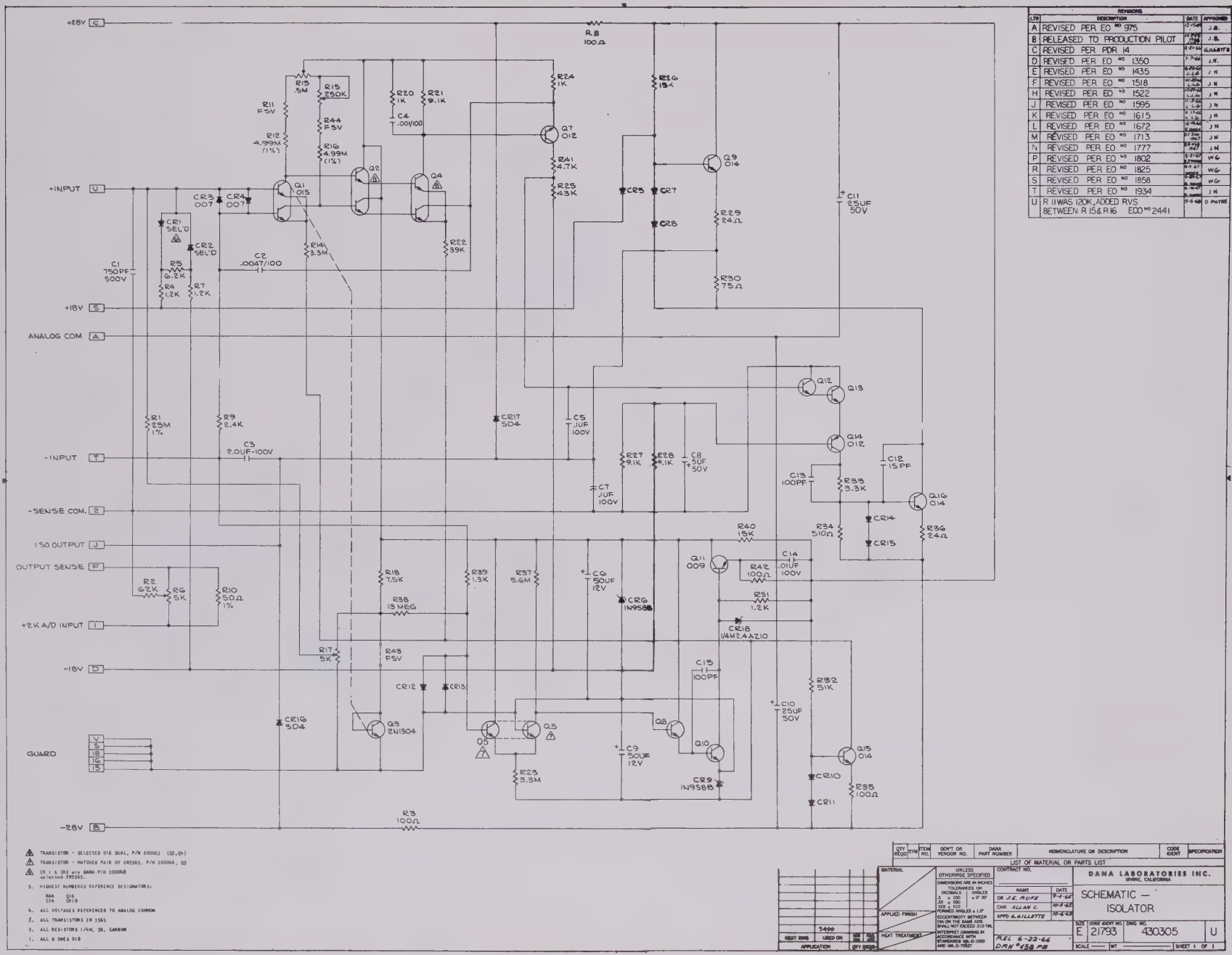
| | NAME | DATE |
|---|---|---|
| DR | R. SCHULTZ | 8/20/68 |
| CHK | | 8/27/68 |
| APPD | D. PAYNE | 8/27/68 |
| | D. PAYNE | 9/3/68 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

PC BOARD ASSY—
ISOLATOR

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| E | 21793 | 402796 | A |

SCALE 4/1 | WT | SHEET 1 OF 1




| LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| A | REVISED PER ECO NO 975 | 12-64 | J.B. |
| B | RELEASED TO PRODUCTION PILOT | 12-64 | J.B. |
| C | REVISED PER PDR 14 | 1-21-65 | GILBERT'S |
| D | REVISED PER ECO NO 1350 | 7-7-65 | J.N. |
| E | REVISED PER ECO NO 1435 | 8-19-65 | J N |
| F | REVISED PER ECO NO 1518 | 10-65 | J N |
| H | REVISED PER ECO NO 1522 | 10-65 | J N |
| J | REVISED PER ECO NO 1595 | 11-3-65 | J N |
| K | REVISED PER ECO NO 1615 | 1-17-66 | J N |
| L | REVISED PER ECO NO 1672 | 3-15-66 | J N |
| M | REVISED PER ECO NO 1713 | 5-23-66 | J N |
| N | REVISED PER ECO NO 1777 | 8-29-66 | J N |
| P | REVISED PER ECO NO 1802 | 9-21-67 | W G |
| R | REVISED PER ECO NO 1825 | 11-7-67 | W G |
| S | REVISED PER ECO NO 1858 | 2-28-67 | W G |
| T | REVISED PER ECO NO 1934 | 8-16-67 | J N |
| U | R 11 WAS 120K, ADDED RVS BETWEEN R 15 & R 16 ECO NO 2441 | 5-5-68 | D PAYNE |

⚠ TRANSISTOR - SELECTED D16 DUAL, P/N 20006 (Q2,Q4)

⚠ TRANSISTOR - MATCHED PAIR OF 2N3565, P/N 20004A, Q5

⚠ CR 1 & CR2 are DANA P/N 20008 selected 2N3565.

5. HIGHEST NUMBERED REFERENCE DESIGNATORS:
   RAA Q16
   CIA CR18

4. ALL VOLTAGES REFERENCED TO ANALOG COMMON

3. ALL TRANSISTORS 2N 3565

2. ALL RESISTORS 1/4W, 5%, CARBON

1. ALL 8 DOES D18

| QTY REQD | SYM | ITEM NO. | GOVT OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| | |
|---|---|
| CONTRACT NO. | |
| NEXT ASSY | USED ON |
| APPLICATION | QTY REQD |

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS ± .020, ± .010, .XXX ± .010
ANGLES ± 0° 30'
FORMED ANGLES ± 1.0°
ECCENTRICITY BETWEEN ON ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.
INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70127

MATERIAL
APPLIED FINISH
HEAT TREATMENT

| NAME | DATE |
|---|---|
| DR J.E. RUFF | 9-1-65 |
| CHK ALLAN C. | 10-8-65 |
| APPD G.GILLETTE | 10-8-65 |

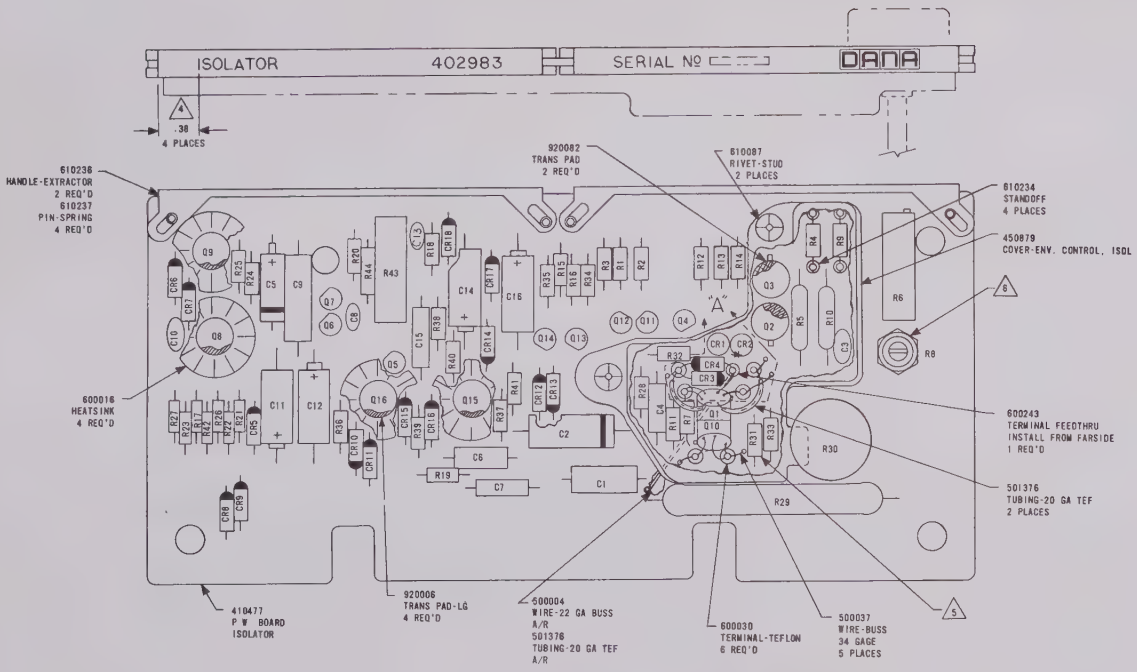
REL 6-22-66
DRN #430 PB

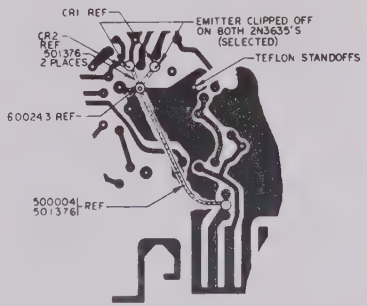
DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC — ISOLATOR

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| E | 21793 | 430305 | U |

SCALE — WT — SHEET 1 OF 1




DETAIL A

(FARSIDE)

⚠4 SOLDER LEADS OF R8, (250k POT) ON BOTH SIDES OF P.W. BOARD

⚠3 INSTALL A 750 OHM 1/4W CARBON RESISTOR (PIN 000750) INITIAL ASSEMBLY

⚠4 HEAT STAMP .10 HIGH BLACK CHARACTERS AND .15 HIGH LOGO, LOCATED AS SHOWN

3 ASSEMBLY PROCEDURES AND PROCESSES TO CONFORM WITH DANA WORKMANSHIP STANDARDS

2 SCHEMATIC REFERENCE: 430816

1 ALL RESISTORS ARE (IN OHMS) 1/4 W. 5%, CARBON

NOTES: UNLESS OTHERWISE SPECIFIED

| NEXT DWG | USED ON | NEXT DWG | FINAL ASSY |
|---|---|---|---|
| 402518 | 031-1 | 1 | 1 |
| 402428 | 031 | 1 | 1 |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON: DECIMALS .X .030 .XX .020 .XXX .010 | ANGLES 0° 30' | HOLE DIAMETERS FORMED +.004 −.001 | 1° 0'

MATERIAL

FINISH

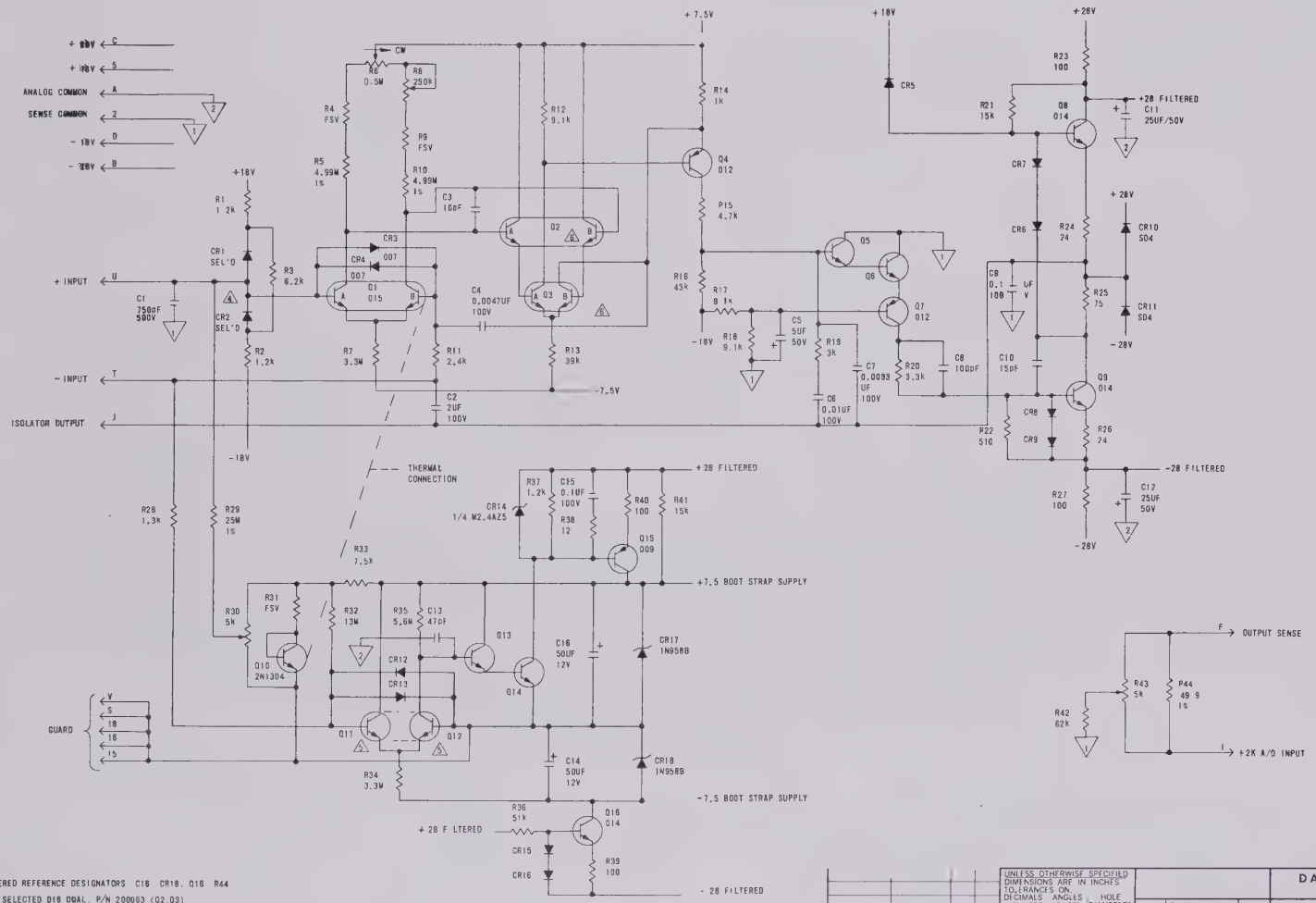
| | | |
|---|---|---|
| DRAWN | P. HASLAM | 7-25-60 |
| CHECK | | 8-24-60 |
| DESIGN | | 10-10-61 |
| MECH ENGR | | 11/8/61 |
| PROJ ENGR | | 10/13/61 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

P.C. BOARD ASSY—
ISOLATOR

| SIZE | CODE IDENT NO. | DWG NO. | REV |
|---|---|---|---|
| D | 21793 | 402983 | B |

SCALE 2 : 1 | SHEET 1 OF 3




7 HIGHEST NUMBERED REFERENCE DESIGNATORS C18 CR18, Q16 R44

⚠1 TRANSISTOR - SELECTED D18 DUAL, P/N 200063 (Q2,Q3)

⚠2 TRANSISTOR - MATCHED PAIR OF 2N3585, P/N 200044 (Q11 Q12)

⚠4 CR1 & CR2 ARE DANA P/N 200048 SELECTED 2N3585

3. ALL TRANSISTORS ARE 2N3585

2. ALL RESISTORS ARE (IN OHMS) 1/4 W, 5% CARBON

1. ALL DIODES ARE 918

NOTES: UNLESS OTHERWISE SPECIFIED

| NEXT DWG | USED ON | NEXT DWG | ORIG ASSY |
|---|---|---|---|
| 402983 | 031-1 | | |
| 402983 | 031 | | |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS ANGLES HOLE
X .030 0.30° DIAMETERS
XX .020 FORMED .004
XXX .010 1.0° .001
MATERIAL
FINISH

| | | |
|---|---|---|
| DRAWN | P. HASLAM | 7-25-68 |
| CHK'R | | |
| DES GN | | |
| MECH ENGR | | 10/9 |
| PROJ ENGR | | 10/9 |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

SCHEMATIC - ISOLATOR

| SIZE | CODE IDENT NO | DWG NO | REV |
|---|---|---|---|
| D | 21793 | 430816 | A |

SCALE NONE SHEET 1 OF 1

| REF DES OR ITEM | P/N | DESCRIPTION | QTY |
|---|---|---|---|
| C1 | 120108 | 750pF/500V | 1 |
| C2 | 120063 | 2UF/100V | 1 |
| C3 | 100006 | 10pF DISC | 1 |
| C4 | 121146 | 0.0047UF/100V | 1 |
| C5 | 110039 | 5UF/50V | 1 |
| C6 | 121088 | 0.01UF/100V | 1 |
| C7 | 120001 | 0.0033UF/100V | 1 |
| C8 | 101145 | 100pF/DISC | 1 |
| C9 | 120003 | 0.1UF/100V | 1 |
| C10 | 100013 | 15pF/DISC | 1 |
| C11 | 110036 | 25UF/50V | 2 |
| C12 | 110036 | 25UF/50V | REF |
| C13 | 101182 | 47pF/DISC | 1 |
| C14 | 110038 | 50UF 12/15V | 2 |
| C15J | 120173 | 0.1UF/100V | 1 |
| C16 | 110038 | 50UF 12/15V | REF |
| CR1 | 200048 | 2N3565 | 2 |
| CR2 | 200048 | 2N3565 | REF |
| CR3 | 211236 | 007 | 2 |
| CR4 | 211236 | 007 | REF |
| CR5 | 211083 | 018 | 9 |
| CR6 | 211083 | 018 | REF |
| CR7 | 211083 | 018 | REF |
| CR8 | 211083 | 018 | REF |
| CR9 | 211083 | 018 | REF |
| CR10 | 210004 | SD4 | 2 |
| CR11 | 210004 | SD4 | REF |
| CR12 | 211083 | 018 | REF |
| CR13 | 211083 | 018 | REF |
| CR14 | 221177 | 1/4M2.4AZ5 | 1 |
| CR15 | 211083 | 018 | REF |
| CR16 | 211083 | 018 | REF |
| CR17 | 220012 | 1N958B | 2 |
| CR18 | 220012 | 1N958B | REF |
| Q1 | 200027 | 015 | 1 |
| Q2 | 200063 | SELECTED 016 | 2 |
| Q3 | 200063 | SELECTED 016 | REF |
| Q4 | 200022 | 012 | 2 |
| Q5 | 200043 | 2N3565 | 4 |
| Q6 | 200043 | 2N3565 | REF |
| Q7 | 200022 | 012 | REF |
| Q8 | 200035 | 014 | 3 |
| Q9 | 200035 | 014 | REF |
| Q10 | 201084 | 2N1304 | 1 |
| Q11 | 200044 | 2N3565 MATCHED PAIR | 1 |
| Q12 | 200044 | 2N3565 MATCHED PAIR | REF |
| Q13 | 200043 | 2N3565 | REF |
| Q14 | 200043 | 2N3565 | REF |
| Q15 | 200011 | 009 | 1 |
| Q16 | 200035 | 014 | REF |
| R1 | 000122 | 1.2k | 3 |
| R2 | 000122 | 1.2k | REF |
| R3 | 000622 | 6.2k | 1 |
| R4 | 001737 | FSV | 3 |
| R5 | 011178 | 4.99 MEG 1% | 2 |
| R6 | 040055 | 50ok POT | 1 |
| R7 | 000335 | 3.3 MEG | 2 |
| R8 | 040057 | 250k POT | 1 |
| R9 | 001737 | FSV | REF |
| R10 | 011178 | 4.99 MEG 1% | REF |
| R11 | 000242 | 2.4k | 1 |
| R12 | 000912 | 9.1k | 3 |
| R13 | 000393 | 39k | 1 |
| R14 | 000102 | 1k | 1 |
| R15 | 000472 | 4.7k | 1 |
| R16 | 000433 | 43k | 1 |
| R17 | 000912 | 9.1k | REF |
| R18 | 000912 | 9.1k | REF |
| R19 | 000303 | 3k | 1 |
| R20 | 000332 | 3.3k | 1 |
| R21 | 000153 | 15k | 2 |
| R22 | 000511 | 510 | 1 |
| R23 | 000101 | 100 | 4 |
| R24 | 000240 | 24 | 2 |
| R25 | 000750 | 75 | 1 |
| R26 | 000240 | 24 | REF |
| R27 | 000101 | 100 | REF |
| R28 | 000132 | 1.3k | 1 |
| R29 | 010249 | 25 MEG 1% | 1 |
| R30 | 040053 | 5k POT | 1 |
| R31 | 001737 | FSV | REF |
| R32 | 000136 | 13 MEG | 1 |
| R33 | 000752 | 7.5k | 1 |
| R34 | 000335 | 3.3 MEG | REF |
| R35 | 000565 | 5.6 MEG | 1 |
| R36 | 000513 | 51k | 1 |
| R37 | 000122 | 1.2k | REF |
| R38 | 000120 | 12 | 1 |
| R39 | 000101 | 100 | REF |
| R40 | 000101 | 100 | REF |
| R41 | 000153 | 15k | REF |
| R42 | 000623 | 62k | 1 |
| R43 | 040050 | 5k POT | 1 |
| R44 | 010308 | 49.9 1% | 1 |
| | | 2N3565 | |
| | | MATCHED PAIR | |
| | | 009 | 1 |
| | | 014 | REF |
| | | | |
| | | 2N958B | 3 |
| | | 2N958B | REF |
| | | FSV | 3 |
| | | 4.99 MEG 1% | 2 |
| | | 50ok POT | 1 |
| | | 3.3 MEG | 2 |
| | | 250k POT | 1 |
| | | FSV | REF |
| | | 4.99 MEG 1% | REF |
| | | 2.4k | 1 |
| | | 9.1k | 3 |
| | | 39k | 1 |
| | | 1k | 1 |
| | | 4.7k | 1 |
| | | 43k | 1 |
| | | 9.1k | REF |
| 000912 | 9.1k | | REF |
| 000303 | 3k | | 1 |
| 0C0332 | 3.3k | | 1 |
| 000153 | 15k | | 2 |
| 000511 | 510 | | 1 |
| 000101 | 100 | | 4 |
| 000240 | 24 | | 2 |
| 000750 | 75 | | 1 |
| 000240 | 24 | | REF |
| 000101 | 100 | | REF |
| 000132 | 1.3k | | 1 |
| 010249 | 25 MEG 1% | | 1 |
| 040053 | 5k POT | | 1 |
| 001737 | FSV | | REF |
| 000136 | 13 MEG | | 1 |
| 000752 | 7.5k | | 1 |
| 000335 | 3.3 MEG | | REF |
| 000565 | 5.6 MEG | | 1 |
| 000513 | 51k | | 1 |
| 000122 | 1.2k | | REF |
| 000120 | 12 | | 1 |
| 000101 | 100 | | REF |
| 000101 | 100 | | REF |
| 000153 | 15k | | REF |
| | | | |
| 000623 | 62k | | 1 |
| 040050 | 5k POT | | 1 |
| 010308 | 49.9 1% | | 1 |
| | | | |
| 410477 | P.W.B. ISOLATOR | | 1 |
| 450879 | COVER ENVIR | | REF |
| | CONT ISOL | | |
| 500004 | WIRE 22GA BUSS | | A/R |
| 500037 | WIRE BUSS 34 GA | | A/R |
| 501376 | TUBING 20 GA TEF | | A/R |
| 600016 | HEAT SINK | | 4 |
| 600030 | TERMINAL TEFLON | | 6 |
| 600243 | TERMINAL FEED-THRU | | 1 |
| 610087 | RIVET STUD | | 2 |
| 610234 | STANDOFF | | 4 |
| 610236 | HANDLE EXTRACTOR | | 2 |
| 610237 | PIN SPRING | | 4 |
| 920006 | TRANS PAD-LRG | | 4 |
| 920082 | TRANS PAD-ROSS | | 2 |
| 920010 | SOLDER-BAR | | A/R |
| 920026 | SOLDER-WIRE | | A/R |
| 430816 | SCHEMATIC | | REF |

NOTES: UNLESS OTHERWISE SPECIFIED

| NEXT DWG | USED ON | NEXT DWG | FINAL ASSY |
|---|---|---|---|
| 402518 | 031-1 | 1 | 1 |
| 402428 | 031 | 1 | 1 |
| APPLICATION | | QTY REQD | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS: X .030, .XX .020, .XXX .010 | ANGLES: 0° 30' FORMED 1° 0' | HOLE DIAMETERS: +.004 -.001
MATERIAL
FINISH

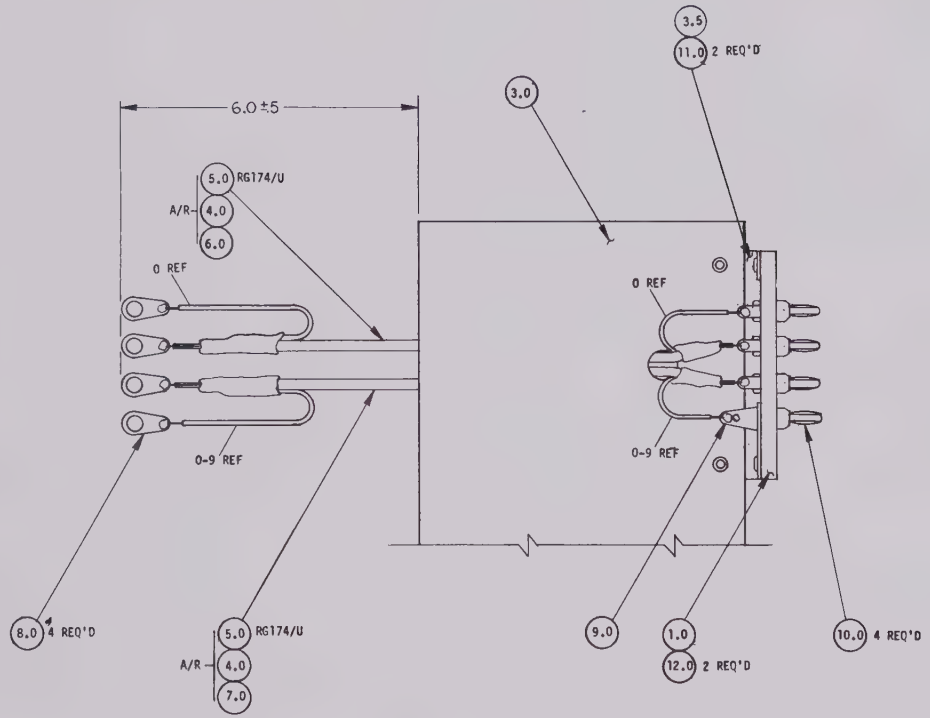
| | | |
|---|---|---|
| DRAWN | P. NASLAM | 7-25-68 |
| CHECK | R. Hayashibara | 10-2-68 |
| DESIGN | R. Schmidt | 10-4-68 |
| MECH ENGR | J. Weber | 10/9/68 |
| PROJ ENGR | O. Payne | 10/8 |
| | G. Mayer 10/17/68 | |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# P.C. BOARD ASSY - ISOLATOR

| SIZE | CODE IDENT NO. | DWG NO. | REV |
|---|---|---|---|
| D | 21793 | 402983 | B |

SCALE NONE | SHEET 2 OF 3




| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO. | PART NO. |
| 1.0 | 450979 |
| 3.0 | 450982 |
| 3.5 | 452168 |
| 4.0 | 500002 |
| 5.0 | 501446 |
| 6.0 | 524000 |
| 7.0 | 524090 |
| 8.0 | 600028 |
| 9.0 | 600032 |
| 10.0 | 600232 |
| 11.0 | 610077 |
| 12.0 | 610138 |

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON

| DECIMALS | ANGLES |
|---|---|
| .X ± .030 | ± 0° 30' |
| .XX ± .020 | |
| .XXX ± .010 | |

FORMED ANGLES ± 1.0°

ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.

INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO.

| NAME | DATE |
|---|---|
| DR | 28 APR 1966 |
| CHK | 30 APRIL 1966 |
| APPD | 3/31/66 |

Rel 6 24 66
DPN 44-

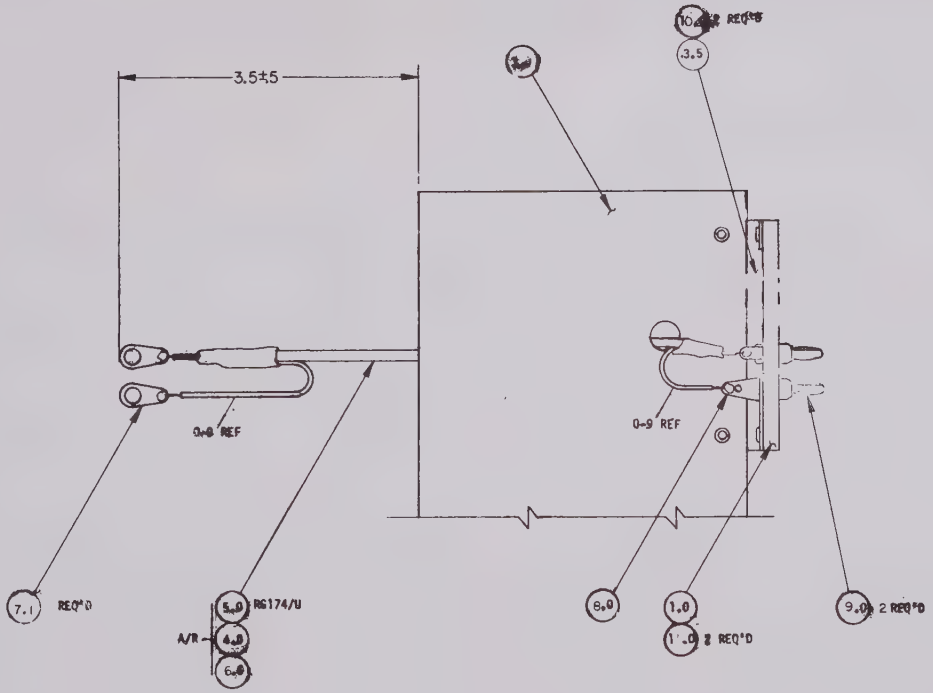
**DANA LABORATORIES INC.**
IRVINE, CALIFORNIA

# REAR INPUT PLUG ASSY 4 WIRE

| SIZE | CODE IDENT NO. | DWG NO. | |
|---|---|---|---|
| C | — | 402009 | C |

SCALE FULL | WT — | SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED




| CROSS REFERENCE CHART | |
|---|---|
| ITEM NO | PART NO |
| 1.0 | 450979 |
| 3.0 | 450982 |
| 3.5 | 452168 |
| 4.0 | 500002 |
| 5.0 | 501446 |
| 6.0 | 524090 |
| 7.1 | 600026 |
| 8.0 | 600032 |
| 9.0 | 600262 |
| 10.0 | 610077 |
| 11.0 | 610138 |

| QTY REQD | SYM | ITEM NO. | GOV'T OR VENDOR NO. | DANA PART NUMBER | NOMENCLATURE OR DESCRIPTION | CODE IDENT | SPECIFICATION |
|---|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

MATERIAL

APPLIED FINISH

HEAT TREATMENT

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON

| DECIMALS | FRACTIONS |
|---|---|
| .X ± .030 | ± .0' |
| .XX ± .020 | |
| .XXX ± .010 | |

FORMED ANGLES ± 1.0°

ECCENTRICITY BETWEEN DIA ON THE SAME AXIS SHALL NOT EXCEED .010 TIR.

INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS MIL-D-1000 AND MIL-D-70327

CONTRACT NO. ———

| | NAME | DATE |
|---|---|---|
| DR | | APR 1966 |
| CHK | | |
| APPD | | |

DANA LABORATORIES INC.
IRVINE, CALIFORNIA

# REAR INPUT PLUG ASSY 2 WIRE

| SIZE | CODE IDENT NO. | DWG NO. |
|---|---|---|
| C | ——— | 402010 B |

SCALE FULL | WT ——— | SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

## PARTS LIST

ASSEMBLY 400858 Attenuator & Control Assy-(020) A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C12 | 120007 | CAP | MYLAR | .22 | MFD | 600 V | 20% | ELEC CUBE | 210B1F224 |
| C15 | 121146 | CAP | MYLAR | .0047 | MFD | 100 V | 10%1 | CDE | WMF1D47 |
| C18 | 121090 | CAP | MYLAR | .015 | MFD | 100 V | 10%1 | CDE | WMF1S15 |
| K03 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| K04 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| K05 | 310021 | RELAY | DC | 2 | PDT | 24V | 1 | ALLIED | AZ42056105 |
| K06 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| R32 | 010164 | RES | METAL | 887 | K | 1% | 1 W | ELECTRA | RN70D8873F |
| R47 | 010208 | RES | METAL | 182 | K | 1% | 1/4 W1 | ELECTRA | RN60D1823F |
| R50 | 000104 | RES | CARBON | 100 | K | 5% | 1/4 W1 | OHMITE | RC07GF104J |

PARTS LIST

ASSEMBLY 400698 Attenuator & Control Assy - Multimeter (030) A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C12 | 120007 | CAP | MYLAR | .22 | MFD | 600 V | 20% | ELEC CUBE | 210B1F224 |
| C15 | 121146 | CAP | MYLAR | .0047 | MFD | 100 V | 10%1 | CDE | WMF1D47 |
| C16 | 121090 | CAP | MYLAR | .015 | MFD | 100 V | 10%1 | CDE | WMF1S15 |
| K02 | 310032 | RELAY | DC | 1 | P | 24V | | | |
| K03 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| K04 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| K05 | 310021 | RELAY | DC | 2 | PDT | 24V | 1 | ALLIED | AZ42056105 |
| K06 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| R32 | 010164 | RES | METAL | 887 | K | 1% | 1 W | ELECTRA | RN70D8873F |
| R47 | 010208 | RES | METAL | 182 | K | 1% | 1/4 W1 | ELECTRA | RN60D1823F |
| R50 | 000104 | RES | CARBON | 100 | K | 5% | 1/4 W1 | OHMITE | RC07GF104J |

PARTS LIST

ASSEMBLY 402966 Attenuator & Control Assy-Multimeter (031) A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CR52 | 211083 | DIODE | SILICO | 018 | | | 1 | DANA | 211083 |
| CR53 | 211083 | DIODE | SILICO | 018 | | | 1 | DANA | 211083 |
| CR54 | 211083 | DIODE | SILICO | 018 | | | 1 | DANA | 211083 |
| CR55 | 211083 | DIODE | SILICO | 018 | | | 1 | DANA | 211083 |
| CR56 | 211083 | DIODE | SILICO | 018 | | | 1 | DANA | 211083 |
| C12 | 120007 | CAP | MYLAR | .22 | MFD | 600 V | 20% | ELEC CUBE | 210B1F224 |
| C15 | 121146 | CAP | MYLAR | .0047 | MFD | 100 V | 10% | CDE | WMF1D47 |
| C16 | 121090 | CAP | MYLAR | .015 | MFD | 100 V | 10%1 | CDE | WMF1S15 |
| K02 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| K03 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| K04 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| K05 | 310021 | RELAY | DC | 2 | PDT | 24V | 1 | ALLIED | AZ42056105 |
| K06 | 310030 | RELAY | DC | 4 | PDT | 28V | 1 | PARELCO | INR10-E046 |
| R32 | 010164 | RES | METAL | 887 | K | 1% | 1 W | ELECTRA | RN70D8873F |
| R47 | 010344 | RES | METAL | 237 | K | 1% | 1/4 W | ELECTRA | RN60D2373F |
| R50 | 000104 | RES | CARBON | 100 | K | 5% | 1/4 W1 | OHMITE | RC07GF104J |

PARTS LIST

ASSEMBLY 402158 PC Board Assy-Switch Panel, 020 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A-CR01 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| B-CR01 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| A-CR02 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| CR03 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| CR04 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| CR26 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| A-CR26 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR27 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| A-CR27 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR28 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| A-CR28 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR37 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR38 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR39 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR40 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR41 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR42 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR43 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR44 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR45 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| CR46 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| CR48 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR49 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR50 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| CR51 | 211083 | DIODE SILICO | 018 | 1 | | DANA | 211083 | |
| C03 | 110044 | CAP ELECT | 50 MFD 50 V | 20% | | DUCATI | 50-50 | |
| C04 | 120026 | CAP MYLAR | .47 MFD 100 V | 10%1 | | IMB | AS2B474K | |
| C05 | 121091 | CAP MYLAR | .033 MFD 100 V | 10%1 | | CDE | WMF1S33 | |
| C06 | 121090 | CAP MYLAR | .015 MFD 100 V | 10%1 | | CDE | WMF1S15 | |
| C07 | 121393 | CAP MYLAR | .22 MFD 100 V | 10% | | CDE | WMF1P22 | |
| C08 | 101182 | CAP CERAM | 47 PFD 500 V | 10%1 | | AEROVOX | TCD-N750 | |
| C09 | 101182 | CAP CERAM | 47 PFD 500 V | 10%1 | | AEROVOX | TCD-N750 | |
| C10 | 120110 | CAP MYLAR | .27 MFD 100 V | 10% | CD | WMF1P27 | | |
| C11 | 120109 | CAP MYLAR | .018 MFD 100 V | 10% | CD | WMF1S18 | | |
| K01 | 310013 | RELAY REED | SPST 24V | 1 | | WHEELOCK | 2961A X6 | |
| Q07 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | |
| Q08 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | |
| Q09 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | |

PARTS LIST

ASSEMBLY 402158 PC Board Assy-Switch Panel, 020 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Q10 | 200035 | TRANS SILICO NPN | | 014 | | | DANA | 200035 |
| Q11 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q12 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q13 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q14 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q15 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q16 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q17 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q18 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| R08 | 000473 | RES | CARBON | 47 K | 5% | 1/4 W1 | OHMITE | RC07GF473J |
| R15 | 000820 | RES | CARBON | 82 OHM | 5% | 1/4 W | OHMITE | RC07GF820J |
| R16 | 000514 | RES | CARBON | 510 K | 5% | 1/4 W1 | OHMITE | RC07GF524J |
| R17 | 000433 | RES | CARBON | 43 K | 5% | 1/4 W | OHMITE | RC07GF433J |
| R18 | 000105 | RES | CARBON | 1 M | 5% | 1/4 W1 | OHMITE | RC07GF105J |
| R19 | 000105 | RES | CARBON | 1 M | 5% | 1/4 W1 | OHMITE | RC07GF105J |
| R20 | 000205 | RES | CARBON | 2 M | 5% | 1/4 W1 | OHMITE | RC07GF205J |
| R21 | 000205 | RES | CARBON | 2 M | 5% | 1/4 W1 | OHMITE | RC07GF205J |
| R22 | 000154 | RES | CARBON | 150 K | 5% | 1/4 W1 | OHMITE | RC07GF154J |
| R23 | 000155 | RES | CARBON | 1.5 M | 5% | 1/4 W | OHMITE | RC07GF155J |
| R24 | 000753 | RES | CARBON | 75 K | 5% | 1/4 W | OHMITE | RC07GF753J |
| R25 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | OHMITE | RC07GF912J |
| R26 | 000754 | RES | CARBON | 750 K | 5% | 1/4 W | OHMITE | RC07GF754J |
| R27 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | OHMITE | RC07GF912J |
| S01 | 600236 | SWITCH ROTARY | | 1 P7P | | | CTS | 55855 |
| S02 | 600218 | SWITCH ROTARY | | 1 P7P | | | CTS | 55854 |

PARTS LIST

ASSEMBLY 400704 PC Board Assy-Switch Panel, 030 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A-CR1 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| B-CR1 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| A-CR2 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| CR03 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| CR26 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| A-CR26 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR27 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| A-CR27 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR28 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| A-CR28 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR37 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR38 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR39 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR40 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR41 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR42 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR43 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR44 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR45 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| CR46 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| CR48 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR49 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | | |
| CR50 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| CR51 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | | |
| C03 | 110044 | CAP ELECT | 50 MFD | 50 V | 20% | DUCATI | 50-50 | | |
| C04 | 120026 | CAP MYLAR | .47 MFD | 100 V | 10%1 | IMB | AS2B474K | | |
| C05 | 121091 | CAP MYLAR | .033 MFD | 100 V | 10%1 | CDE | WMF1533 | | |
| C06 | 121090 | CAP MYLAR | .015 MFD | 100 V | 10%1 | CDE | WMF1S15 | | |
| C07 | 121393 | CAP MYLAR | .22 MFD | 100 V | 10% | CDE | WMF1P22 | | |
| C08 | 101182 | CAP CERAM | 47 PFD | 500 V | 10%1 | AEROVOX | TCD-N750 | | |
| C09 | 101182 | CAP CERAM | 47 PFD | 500 V | 10%1 | AEROVOX | TCD-N750 | | |
| C10 | 120110 | CAP MYLAR | .27 MFD | 100 V | 10% | CD | WMF1P27 | | |
| C11 | 120109 | CAP MYLAR | .018 MFD | 100 V | 10% | CD | WMF1S18 | | |
| K01 | 310013 | RELAY REED | SPST | 24V | 1 | WHEELOCK | 2961A X6 | | |
| Q07 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | | |
| Q08 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | | |
| Q09 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | | |
| Q10 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | | |

## PARTS LIST

ASSEMBLY 400704 PC Board Assy-Switch Panel, 030 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Q11 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q12 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q13 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q14 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q15 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q16 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q17 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q18 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| R08 | 000473 | RES | CARBON | 47 K | 5% | 1/4 | W1 | OHMITE | RC07GF473J |
| R15 | 000820 | RES | CARBON | 82 OHM | 5% | 1/4 | W | OHMITE | RC07GF820J |
| R16 | 000514 | RES | CARBON | 510 K | 5% | 1/4 | W1 | OHMITE | RC07GF524J |
| R17 | 000433 | RES | CARBON | 43 K | 5% | 1/4 | W | OHMITE | RC07GF433J |
| R18 | 000105 | RES | CARBON | 1 M | 5% | 1/4 | W1 | OHMITE | RC07GF105J |
| R19 | 000105 | RES | CARBON | 1 M | 5% | 1/4 | W1 | OHMITE | RC07GF105J |
| R20 | 000205 | RES | CARBON | 2 M | 5% | 1/4 | W1 | OHMITE | RC07GF205J |
| R21 | 000205 | RES | CARBON | 2 M | 5% | 1/4 | W1 | OHMITE | RC07GF205J |
| R22 | 000154 | RES | CARBON | 150 K | 5% | 1/4 | W1 | OHMITE | RC07GF154J |
| R23 | 000155 | RES | CARBON | 1.5 M | 5% | 1/4 | W | OHMITE | RC07GF155J |
| R24 | 000753 | RES | CARBON | 75 K | 5% | 1/4 | W | OHMITE | RC07GF753J |
| R25 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 | W1 | OHMITE | RC07GF912J |
| R26 | 000754 | RES | CARBON | 750 K | 5% | 1/4 | W | OHMITE | RC07GF754J |
| R27 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 | W1 | OHMITE | RC07GF912J |

PARTS LIST

ASSEMBLY 402967 PC Board Assy-Switch Panel, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CR01 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| A-CR01 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR02 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR03 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR26 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| A-CR26 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR27 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR28 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| A-CR28 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR37 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR38 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR39 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR40 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR41 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR42 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR43 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR44 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR45 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR46 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR48 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR49 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR50 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR51 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR52 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR53 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR54 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR55 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR56 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR57 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| C03 | 110044 | CAP ELECT | 50 MFD | 50 V | 20% | | DUCATI | 50-50 |
| C04 | 120012 | CAP MYLAR | 1 MFD | 200 V | %1 | | IMB | XAZC105J |
| C05 | 120147 | CAP POLY | .0283 MFD | 200 V | 5% | | ELPAC | PD2X2832J |
| C06 | 120146 | CAP POLY | .043 MFD | 200 V | 5% | | ELPAC | PD2X433J |
| C07 | 120026 | CAP MYLAR | .47 MFD | 100 V | 10%1 | | IMB | AS2B474K |
| C08 | 101182 | CAP CERAM | 47 PFD | 500 V | 10%1 | | AEROVOX | TCD-N750 |
| C09 | 101182 | CAP CERAM | 47 PFD | 500 V | 10%1 | | AEROVOX | TCD-N750 |
| C10 | 120026 | CAP MYLAR | .47 MFD | 100 V | 10%1 | | IMB | AS2B474K |
| C11 | 120148 | CAP POLY | .0506 MFD | 50 V | 5% | | ELPAC | PD2X5062J |

PARTS LIST

ASSEMBLY 402967 PC Board Assy-Switch Panel, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION |
|---|---|---|
| K01 | 310013 | RELAY REED SPST 24V 1 WHEELOCK 2961A X6 |
| Q07 | 200035 | TRANS SILICO NPN 014 DANA 200035 |
| Q08 | 200035 | TRANS SILICO NPN 014 DANA 200035 |
| Q09 | 200079 | TRANS 021 DANA 200079 |
| Q10 | 200079 | TRANS 021 DANA 200079 |
| Q11 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q12 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q13 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q14 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q15 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q16 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q17 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q18 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| R08 | 000473 | RES CARBON 47 K 5% 1/4 W1 OHMITE RC07GF473J |
| R15 | 000820 | RES CARBON 82 OHM 5% 1/4 W OHMITE RC07GF820J |
| R16 | 010342 | RES METAL 649 K 1% IRC RN65D6493F |
| R17 | 000433 | RES CARBON 43 K 5% 1/4 W OHMITE RC07GF433J |
| R18 | 000105 | RES CARBON 1 M 5% 1/4 W1 OHMITE RC07GF105J |
| R19 | 000105 | RES CARBON 1 M 5% 1/4 W1 OHMITE RC07GF105J |
| R20 | 000205 | RES CARBON 2 M 5% 1/4 W1 OHMITE RC07GF205J |
| R21 | 000205 | RES CARBON 2 M 5% 1/4 W1 OHMITE RC07GF205J |
| R22 | 000154 | RES CARBON 150 K 5% 1/4 W1 OHMITE RC07GF154J |
| R23 | 010343 | RES METAL 1 MEG 1% CORNING RN6501004F |
| R24 | 000753 | RES CARBON 75 K 5% 1/4 W OHMITE RC07GF753J |
| R25 | 000912 | RES CARBON 9.1 K 5% 1/4 W1 OHMITE RC07GF912J |
| R26 | 010149 | RES METAL 499 OHM 1% 1/4 W ELECTRA RN60D4990F |
| R27 | 000912 | RES CARBON 9.1 K 5% 1/4 W1 OHMITE RC07GF912J |
| S01 | 600416 | SWITCH ROTARY 1P 7P DANA 600416 |
| S02 | 600415 | SWITCH ROTARY 1P 7P DANA 600415 |

PCB APCB ASSEMBLY AUTO POLARITY - 402056

## P A R T S  L I S T

| REF DES | DANA P/N | PART | TYPE | DESCRIPTION | MANUFAC | MANUFAC P/N |
|---|---|---|---|---|---|---|
| C1 | 120039 | CAP | POLYS | 24 PFD 500 V 5% | CRL | CPR-24J |
| C2 | 120039 | CAP | POLYS | 24 PFD 500 V 5% | CRL | CPR-24J |
| C3 | 101145 | CAP | CERAM | 100 PFD 500 V 10% | AEROVOX | SCD1X5F |
| C4 | 101145 | CAP | CERAM | 100 PFD 500 V 10% | AEROVOX | SCD1X5F |
| C5 | 101145 | CAP | CERAM | 100 PFD 500 V 10% | AEROVOX | SCD1X5F |
| C6 | 110039 | CAP | ELECT | 5 MFD 50 V 20% | DUCATI | 5-50 |
| C7 | 110036 | CAP | ELECT | 25 MFD 50 V 20% | DUCATI | 25-50 |
| C8 | 101145 | CAP | CERAM | 100 PFD 500 V 10% | AEROVOX | SCD1X5F |
| C10 | 101145 | CAP | CERAM | 100 PFD 500 V 10% | AEROVOX | SCD1X5F |
| C11 | 101098 | CAP | CERAM | 330 PFD 500 V 10% | AEROVOX | SCD1X5F |
| C12 | 101098 | CAP | CERAM | 330 PFD 500 V 10% | AEROVOX | SCD1X5F |
| CR1 THRU CR4 | 211083 | DIODE | SILICO | 018 | DANA | 211083 |
| CR5 | 210006 | DIODE | SILICO | S368 | G.E. | S368 |
| CR6 | 210006 | DIODE | SILICO | S368 | G.E. | S368 |
| CR7 THRU CR10 | 211083 | DIODE | SILICO | 018 | DANA | 211083 |
| CR11 | 221177 | DIODE | SILICO | ZENER 1/4 W | MOTOROLA | M.2.4A25 |
| Q1 | 200040 | TRANS | SILICO | NPN 016 | DANA | 200040 |
| Q2 | 200043 | TRANS | SILICO | NPN 2N3565 | FAIRCHILD | 2N3565 |
| Q3 | 200043 | TRANS | SILICO | NPN 2N3565 | FAIRCHILD | 2N3565 |
| Q4 | 200037 | TRANS | SILICO | NPN 2N3646 | FAIRCHILD | 2N3646 |
| Q5 | 200037 | TRANS | SILICO | NPN 2N3646 | FAIRCHILD | 2N3646 |
| Q6 | 200011 | TRANS | SILICO | PNP 009 | DANA | 200011 |
| Q7 | 200035 | TRANS | SILICO | NPN 014 | DANA | 200035 |
| Q8 | 200035 | TRANS | SILICO | NPN 014 | DANA | 200035 |
| Q9 | 200043 | TRANS | SILICO | NPN 2N3565 | FAIRCHILD | 2N3565 |
| Q10 | 200043 | TRANS | SILICO | NPN 2N3565 | FAIRCHILD | 2N3565 |
| Q11 | 200037 | TRANS | SILICO | NPN 2N3646 | FAIRCHILD | 2N3646 |
| Q12 | 200037 | TRANS | SILICO | NPN 2N3646 | FAIRCHILD | 2N3646 |
| R1 | 000202 | RES | CARBON | 2 K 5% 1/4 W | OHMITE | RC07GF202J |
| R2 | 010137 | RES | METAL | 100 OHM 1% 1/4 W | ELECTRA | RN60D1000F |
| R3 | 040050 | RES | VARI | 5 K 10% 1/2 W | BOURNS | 3067-P-1-K02 |
| R4 | 000393 | RES | CARBON | 39 K 5% 1/4 W | OHMITE | RC07GF393J |
| R5 | 020166 | RES | WW | 10 K .05% 1/8 W | JORDAN | LR-11 |
| R6 | 000243 | RES | CARBON | 24 K 5% 1/4 W | OHMITE | RC07GF243J |
| R7 | 000243 | RES | CARBON | 24 K 5% 1/4 W | OHMITE | RC07GF243J |

PCB APCB ASSEMBLY AUTO POLARITY - 402056

## P A R T S  L I S T

| REF DES | DANA P/N | PART | TYPE | DESCRIPTION | | | MANUFAC | MANUFAC P/N |
|---|---|---|---|---|---|---|---|---|
| R8 | 020166 | RES | WW | 10 K | .05% | 1/8 W | JORDAN | LR-11 |
| R9 | 010038 | RES | METAL | 422 K | 1% | 1/4 W | ELECTRA | RN60D4223F |
| R10 | 000102 | RES | CARBON | 1 K | 5% | 1/4 W | OHMITE | RC07GF102J |
| R11 | 040054 | RES | VARI | 50 K | 10% | 1/5 W | BOURNS | 3068-P-1503 |
| R12 | 010038 | RES | METAL | 422 K | 1% | 1/4 W | ELECTRA | RN60D4223F |
| R13 | 000184 | RES | CARBON | 180 K | 5% | 1/4 W | OHMITE | RC07GF184J |
| R14 | 000184 | RES | CARBON | 180 K | 5% | 1/4 W | OHMITE | RC07GF184J |
| R15 | 000102 | RES | CARBON | 1 K | 5% | 1/4 W | OHMITE | RC07GF102J |
| R17 | 010137 | RES | METAL | 100 OHM | 1% | 1/4 W | ELECTRA | RN60D1000F |
| R18 | 000472 | RES | CARBON | 4.7 K | 5% | 1/4 W | OHMITE | RC07GF472J |
| R19 | 000910 | RES | CARBON | 91 OHM | 5% | 1/4 W | OHMITE | RC07GF910J |
| R20 | 000472 | RES | CARBON | 4.7 K | 5% | 1/4 W | OHMITE | RC07GF472J |
| R21 | 000910 | RES | CARBON | 91 OHM | 5% | 1/4 W | OHMITE | RC07GF910J |
| R22 | 000103 | RES | CARBON | 10 K | 5% | 1/4 W | OHMITE | RC07GF103J |
| R23 | 000201 | RES | CARBON | 200 OHM | 5% | 1/4 W | OHMITE | RC07GF201J |
| R24 | 000470 | RES | CARBON | 47 OHM | 5% | 1/4 W | OHMITE | RC07GF470J |
| R25 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W | OHMITE | RC07GF153J |
| R26 | 000183 | RES | CARBON | 18 K | 5% | 1/4 W | OHMITE | RC07GF183J |
| R27 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W | OHMITE | RC07GF153J |
| R28 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W | OHMITE | RC07GF153J |
| R29 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W | OHMITE | RC07GF153J |
| R32 | 000163 | RES | CARBON | 16 K | 5% | 1/4 W | OHMITE | RC07GF163J |
| R33 | 000303 | RES | CARBON | 30 K | 5% | 1/4 W | OHMITE | RC07GF303J |
| R34 | 000163 | RES | CARBON | 16 K | 5% | 1/4 W | OHMITE | RC07GF163J |
| R35 | 000303 | RES | CARBON | 30 K | 5% | 1/4 W | OHMITE | RC07GF303J |
| R36 | 020166 | RES | WW | 10 K | .05% | 1/8 W | JORDAN | LR-11 |
| R37 | 000391 | RES | CARBON | 390 OHM | 5% | 1/4 W | OHMITE | RC07GF391J |

PARTS LIST

ASSEMBLY 402661 **PC BOARD ASSY. AUTO POLARITY**

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR02 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR04 | 210013 | DIODE SILICO | 1N916 | | | DANA | 210013 | |
| CR05 | 210013 | DIODE SILICO | 1N916 | | | DANA | 210013 | |
| CR06 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR07 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR09 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR10 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR11 | 221177 | DIODE SILICO ZENER | | | 1/4 W1 | MOTOROLA | M.2.4A25 | |
| C01 | 120035 | CAP POLYS | 33 PFD | 500 V | 5%1 | CRL | CPR-33J | |
| C02 | 120035 | CAP POLYS | 33 PFD | 500 V | 5%1 | CRL | CPR-33J | |
| C03 | 101145 | CAP CERAM | 100 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C04 | 101145 | CAP CERAM | 100 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C05 | 101145 | CAP CERAM | 100 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C06 | 110039 | CAP ELECT | 5 MFD | 50 V | 20% | DUCATI | 5-50 | |
| C07 | 110036 | CAP ELECT | 25 MFD | 50 V | 20% | DUCATI | 25-50 | |
| C08 | 101145 | CAP CERAM | 100 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C10 | 101145 | CAP CERAM | 100 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C11 | 101098 | CAP CERAM | 330 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C12 | 101098 | CAP CERAM | 330 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| Q01 | 200062 | | | | | | | |
| Q02 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 | |
| Q03 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 | |
| Q04 | 200037 | TRANS SILICO NPN | 2N3646 | | | FAIRCHILD | 2N3646 | |
| Q05 | 200037 | TRANS SILICO NPN | 2N3646 | | | FAIRCHILD | 2N3646 | |
| Q06 | 200011 | TRANS SILICO PNP | 009 | | | DANA | 200011 | |
| Q07 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | |
| Q08 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 | |
| Q09 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 | |
| Q10 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 | |
| Q11 | 200037 | TRANS SILICO NPN | 2N3646 | | | FAIRCHILD | 2N3646 | |
| Q12 | 200037 | TRANS SILICO NPN | 2N3646 | | | FAIRCHILD | 2N3646 | |
| R01 | 000202 | RES CARBON | 2 K | 5% | 1/4 W1 | OHMITE | RC07GF202J | |
| R02 | 010137 | RES METAL | 100 OHM | 1% | 1/8 W | ELECTRA | RN60D1000F | |
| R03 | 040050 | RES VARI | 5 K | 10% | 1.0 W | BOURNS | 3067-P-1-K0 | |
| R04 | 000393 | RES CARBON | 39 K | 5% | 1/4 W | OHMITE | RC07GF393J | |
| R05 | 020166 | RES WW | 10 K | .05% | 1/8 W | JORDAN | LR-11 | |
| R06 | 000243 | RES CARBON | 24 K | 5% | 1/4 W1 | OHMITE | RC07GF243J | |

PARTS LIST

ASSEMBLY 402661 **PC BOARD ASSY. AUTO POLARITY**

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R07 | 000243 | RES | CARBON | 24 | K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R08 | 020166 | RES | WW | 10 | K | .05% | 1/8 W | JORDAN | LR-11 |
| R09 | 010038 | RES | METAL | 422 | K | 1% | 1/4 W | ELECTRA | RN60D4223F |
| R10 | 000102 | RES | CARBON | 1 | K | 5% | 1/4 W1 | OHMITE | RC07GF102J |
| R11 | 040054 | RES | VARI | 50 | K | 10% | 1/5 W | BOURNS | 3068-P-1503 |
| R12 | 010038 | RES | METAL | 422 | K | 1% | 1/4 W | ELECTRA | RN60D4223F |
| R13 | 000184 | RES | CARBON | 180 | K | 5% | 1/4 W | OHMITE | RC07GF184J |
| R14 | 000184 | RES | CARBON | 180 | K | 5% | 1/4 W | OHMITE | RC07GF184J |
| R15 | 000102 | RES | CARBON | 1 | K | 5% | 1/4 W1 | OHMITE | RC07GF102J |
| R17 | 000102 | RES | CARBON | 1 | K | 5% | 1/4 W1 | OHMITE | RC07GF102J |
| R18 | 000472 | RES | CARBON | 4.7 | K | 5% | 1/4 W1 | OHMITE | RC07GF472J |
| R19 | 000910 | RES | CARBON | 91 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF910J |
| R20 | 000472 | RES | CARBON | 4.7 | K | 5% | 1/4 W1 | OHMITE | RC07GF472J |
| R21 | 000910 | RES | CARBON | 91 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF910J |
| R22 | 000103 | RES | CARBON | 10 | K | 5% | 1/4 W1 | OHMITE | RC07GF103J |
| R23 | 000201 | RES | CARBON | 200 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF201J |
| R24 | 000470 | RES | CARBON | 47 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF470J |
| R25 | 000153 | RES | CARBON | 15 | K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R26 | 000183 | RES | CARBON | 18 | K | 5% | 1/4 W1 | OHMITE | RC07GF183J |
| R27 | 000153 | RES | CARBON | 15 | K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R28 | 000153 | RES | CARBON | 15 | K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R29 | 000153 | RES | CARBON | 15 | K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R32 | 000163 | RES | CARBON | 16 | K | 5% | 1/4 W1 | OHMITE | RC07GF163J |
| R33 | 000303 | RES | CARBON | 30 | K | 5% | 1/4 W1 | OHMITE | RC07GF303J |
| R34 | 000163 | RES | CARBON | 16 | K | 5% | 1/4 W1 | OHMITE | RC07GF163J |
| R35 | 000303 | RES | CARBON | 30 | K | 5% | 1/4 W1 | OHMITE | RC07GF303J |
| R36 | 020166 | RES | WW | 10 | K | .05% | 1/8 W | JORDAN | LR-11 |
| R37 | 000391 | RES | CARBON | 390 | OHM | 5% | 1/4 W | OHMITE | RC07GF391J |
| R38 | 000273 | RES | CARBON | 27 | K | 5% | 1/4 W1 | OHMITE | RC07GF273J |

PARTS LIST

ASSEMBLY 402197 PC Board Assy-Range Control, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CR01 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| A-CR01 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR02 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| B-CR02 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| C-CR02 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| K-CR02 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| L-CR02 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| P-CR02 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR03 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| A-CR03 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| M-CR03 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR04 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| A-CR04 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| C-CR05 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR25 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR26 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR27 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR28 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| CR37 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR38 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR39 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR40 | 210004 | DIODE SILICO | SD4 | | | | DIODES IN SD4 | |
| CR41 | 211083 | DIODE SILICO | 018 | | | 1 | DANA | 211083 |
| C01 | 101174 | CAP CERAM | .001 MFD | 500 V | 10%1 | | AEROVOX | SCD3X5F |
| E-C01 | 121092 | CAP MYLAR | .0022 MFD | 100 V | 10% | | CDE | WMF1D22 |
| C03 | 121092 | CAP MYLAR | .0022 MFD | 100 V | 10% | | CDE | WMF1D22 |
| Q03 | 200043 | TRANS SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q04 | 200035 | TRANS SILICO NPN | 014 | | | | DANA | 200035 |
| Q07 | 200043 | TRANS SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q08 | 200043 | TRANS SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q09 | 200043 | TRANS SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q10 | 200043 | TRANS SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q11 | 200043 | TRANS SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| R05 | 000822 | RES CARBON | 8.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF822J |
| R06 | 000153 | RES CARBON | 15 K | 5% | 1/4 W1 | | OHMITE | RC07GF153J |
| R07 | 000204 | RES CARBON | 200 K | 5% | 1/4 W | | OHMITE | RC07GF204J |
| R08 | 000682 | RES CARBON | 6.8 K | 5% | 1/4 W1 | | OHMITE | RC07GF682J |
| C-R08 | 000123 | RES CARBON | 12 K | 5% | 1/4 W1 | | OHMITE | RC07GF123J |

PARTS LIST

ASSEMBLY 402197 PC Board Assy-Range Control (031) A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| D-R08 | 000123 | RES | CARBON | 12 K | 5% | 1/4 W1 | OHMITE | RC07GF123J |
| E-R08 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| F-R08 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| J-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| K-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| L-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| M-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| P-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R10 | 000273 | RES | CARBON | 27 K | 5% | 1/4 W1 | OHMITE | RC07GF273J |
| R16 | 000222 | RES | CARBON | 2.2 K | 5% | 1/4 W1 | OHMITE | RC07GF222J |
| R17 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R18 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| R19 | 000222 | RES | CARBON | 2.2 K | 5% | 1/4 W1 | OHMITE | RC07GF222J |
| R20 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R21 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| R22 | 000243 | RES | CARBON | 24 K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R23 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R24 | 000104 | RES | CARBON | 100 K | 5% | 1/4 W1 | OHMITE | RC07GF104J |
| R26 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R27 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R28 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |

PARTS LIST

ASSEMBLY 402382 PC Board Assy-Range Control, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | |
|---|---|---|---|---|---|---|---|
| CR01 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| A-CR01 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| L-CR01 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| P-CR01 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR02 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| A-CR02 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| B-CR02 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| K-CR02 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| P-CR02 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR03 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| A-CR03 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| D-CR03 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| K-CR03 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| L-CR03 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| P-CR03 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR04 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| A-CR04 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| R-CR04 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR05 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| A-CR05 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| R-CR05 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR06 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR25 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR26 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR27 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR28 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR37 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR38 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR39 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR40 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR41 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| C01 | 101174 | CAP CERAM | .001 MFD 500 V | 10%1 | AEROVOX | SCD3X5F | |
| F-C01 | 121092 | CAP MYLAR | .0022 MFD 100 V | 10% | CDE | WMF1D22 | |
| C02 | 121092 | CAP MYLAR | .0022 MFD 100 V | 10% | CDE | WMF1D22 | |
| Q03 | 200043 | TRANS SILICO NPN | 2N3565 | | FAIRCHILD | 2N3565 | |
| C-Q03 | 200037 | TRANS SILICO NPN | 2N3646 | | FAIRCHILD | 2N3646 | |
| Q04 | 200079 | TRANS | 021 | | DANA | 200079 | |
| Q07 | 200043 | TRANS SILICO NPN | 2N3565 | | FAIRCHILD | 2N3565 | |

PARTS LIST

ASSEMBLY 402382 PC Board Assy-Range Control, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Q08 | 200043 | TRANS SILICO NPN | | | 2N3565 | | FAIRCHILD | 2N3565 |
| Q09 | 200043 | TRANS SILICO NPN | | | 2N3565 | | FAIRCHILD | 2N3565 |
| Q10 | 200043 | TRANS SILICO NPN | | | 2N3565 | | FAIRCHILD | 2N3565 |
| R05 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R06 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R07 | 000204 | RES | CARBON | 200 K | 5% | 1/4 W | OHMITE | RC07GF204J |
| R08 | 000243 | RES | CARBON | 24 K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| C-R08 | 000123 | RES | CARBON | 12 K | 5% | 1/4 W1 | OHMITE | RC07GF123J |
| D-R08 | 000123 | RES | CARBON | 12 K | 5% | 1/4 W1 | OHMITE | RC07GF123J |
| E-R08 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| F-R08 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| J-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| K-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| L-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| M-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| N-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| P-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| V-R08 | 000682 | RES | CARBON | 6.8 K | 5% | 1/4 W1 | OHMITE | RC07GF682J |
| R10 | 000273 | RES | CARBON | 27 K | 5% | 1/4 W1 | OHMITE | RC07GF273J |
| R16 | 000222 | RES | CARBON | 2.2 K | 5% | 1/4 W1 | OHMITE | RC07GF222J |
| R17 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R18 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| R19 | 000222 | RES | CARBON | 2.2 K | 5% | 1/4 W1 | OHMITE | RC07GF222J |
| R20 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R21 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| R22 | 000243 | RES | CARBON | 24 K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R23 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R24 | 000104 | RES | CARBON | 100 K | 5% | 1/4 W1 | OHMITE | RC07GF104J |
| R26 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R27 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R28 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| R29 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |

# PARTS LIST

ASSEMBLY 402695 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | |
|---|---|---|---|---|---|---|---|
| CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| A-CR01 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| L-CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| P-CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR02 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| A-CR02 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| B-CR02 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| K-CR02 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| P-CR02 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR03 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| A-CR03 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| B-CR03 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| K-CR03 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| L-CR03 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| P-CR03 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR04 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| A-CR04 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| R-CR04 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR05 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| A-CR05 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| R-CR05 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR06 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR25 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR26 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR27 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR28 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR37 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR38 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR39 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR40 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR41 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR42 | 220034 | DIODE SILICO | IN960B | | | MOTOROLA | IN 960B |
| C01 | 101174 | CAP CERAM | .001 MFD 500 V | 10%1 | | AEROVOX | SCD3X5F |
| E-C01 | 121092 | CAP MYLAR | .0022 MFD 100 V | 10% | | CDE | WMF1D22 |
| C03 | 110053 | CAP TANTA | .68 MFD 35 V | 10% | | KEMET | KR68R35K |
| Q03 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 |
| C-Q03 | 200037 | TRANS SILICO NPN | 2N3646 | | | FAIRCHILD | 2N3646 |
| Q04 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 |

PARTS LIST

ASSEMBLY 402695 PC Board Assy-Range Control, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Q07 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q08 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q09 | 200043 | TRANS SILICO NPN | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q10 | 200037 | TRANS SILICO NPN | | 2N3646 | | | FAIRCHILD | 2N3646 |
| R05 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R06 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R07 | 000204 | RES | CARBON | 200 K | 5% | 1/4 W | OHMITE | RC07GF204J |
| R08 | 000243 | RES | CARBON | 24 K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| C-R08 | 000123 | RES | CARBON | 12 K | 5% | 1/4 W1 | OHMITE | RC07GF123J |
| D-R08 | 000123 | RES | CARBON | 12 K | 5% | 1/4 W1 | OHMITE | RC07GF123J |
| E-R08 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| F-R08 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| J-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| K-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| L-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| M-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| N-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| P-R08 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| V-R08 | 000682 | RES | CARBON | 6.8 K | 5% | 1/4 W1 | OHMITE | RC07GF682J |
| R10 | 000273 | RES | CARBON | 27 K | 5% | 1/4 W1 | OHMITE | RC07GF273J |
| R16 | 000222 | RES | CARBON | 2.2 K | 5% | 1/4 W1 | OHMITE | RC07GF222J |
| R17 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R18 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| R19 | 000222 | RES | CARBON | 2.2 K | 5% | 1/4 W1 | OHMITE | RC07GF222J |
| R20 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R21 | 000512 | RES | CARBON | 5.1 K | 5% | 1/4 W1 | OHMITE | RC07GF512J |
| R22 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R23 | 000822 | RES | CARBON | 8.2 K | 5% | 1/4 W1 | OHMITE | RC07GF822J |
| R24 | 000104 | RES | CARBON | 100 K | 5% | 1/4 W1 | OHMITE | RC07GF104J |
| R26 | 000202 | RES | CARBON | 2 K | 5% | 1/4 W1 | OHMITE | RC07GF202J |
| R28 | 000104 | RES | CARBON | 100 K | 5% | 1/4 W1 | OHMITE | RC07GF104J |

PARTS LIST

ASSEMBLY 400705 PC Board Assy-Ohms Converter, 030 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A-CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| B-CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| C-CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| D-CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| A-CR02 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| B-CR02 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| C-CR02 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| D-CR02 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| D-CR03 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR13 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR14 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR15 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR16 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 |
| CR17 | 221177 | DIODE SILICO ZENER | | 1/4 W1 | | MOTOROLA | M.2.4A25 |
| CR18 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| CR19 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | |
| C01 | 110040 | CAP ELECT | 1 MFD 50 V | 20% | | DUCATI | 1-50 |
| C02 | 121146 | CAP MYLAR | .0047 MFD 100 V | 10%1 | | CDE | WMF1D47 |
| C03 | 101174 | CAP CERAM | .001 MFD 500 V | 10%1 | | AEROVOX | SCD3X5F |
| C04 | 101174 | CAP CERAM | .001 MFD 500 V | 10%1 | | AEROVOX | SCD3X5F |
| C05 | 101145 | CAP CERAM | 100 PFD 500 V | 10%1 | | AEROVOX | SCD1X5F |
| Q01 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 |
| Q02 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 |
| Q03 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 |
| Q04 | 200035 | TRANS SILICO NPN | 014 | | | DANA | 200035 |
| Q06 | 200040 | TRANS SILICO NPN | 016 | | | DANA | 200040 |
| Q07 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q08 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q09 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q10 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q11 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q12 | 200043 | TRANS SILICO NPN | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q13 | 200011 | TRANS SILICO PNP | 009 | | | DANA | 200011 |
| R02 | 010288 | RES METAL | 5 M | 1% | 1 W | PYROFILM | PME75T2 |
| R03 | 040054 | RES VARI | 50 K | 10% | 1/5 W | BOURNS | 3068-P-1503 |
| R04 | 020241 | RES WW | 10 K | .05% | 1/8 W | JORDAN | J-11 |
| R05 | 020237 | RES WW | 5.02 K | .05% | 1/8 W | JORDAN | J-11 |
| R06 | 020237 | RES WW | 5.02 K | .05% | 1/8 W | JORDAN | J-11 |

PARTS LIST

ASSEMBLY 400705 PC Board Assy-Ohms Converter, 030 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R07 | 020241 | RES | WW | 10 | K | .05% | 1/8 | W | JORDAN J-11 |
| R08 | 000473 | RES | CARBON | 47 | K | 5% | 1/4 | W1 | OHMITE RC07GF473J |
| R09 | 010289 | RES | METAL | 555.5 | K | .1% | 1/2 | W | PYROFILM PME65T2 |
| R10 | 040053 | RES | VARI | 5 | K | 10% | 1.5 | W | CTS 110 |
| R11 | 010246 | RES | METAL | 54.9 | K | 1% | 1/4 | W | ELECTRA RN60D5492F |
| R12 | 040005 | RES | VARI | 10 | K | 10% | 1/2 | W | BOURNS 3067-P-1-10 |
| R13 | 010246 | RES | METAL | 54.9 | K | 1% | 1/4 | W | ELECTRA RN60D5492F |
| R14 | 000242 | RES | CARBON | 2.4 | K | 5% | 1/4 | W1 | OHMITE RC07GF242J |
| R15 | 020238 | RES | WW | 50.5 | K | .1% | 1/8 | W | JORDAN J-11 |
| R16 | 040062 | RES | VARI | 500 | OHM | 10% | 1.5 | W | CTS 110 |
| R17 | 000623 | RES | CARBON | 62 | K | 5% | 1/4 | W1 | OHMITE RC07GF623J |
| R18 | 000152 | RES | CARBON | 1.5 | K | 5% | 1/4 | W1 | OHMITE RC07GF152J |
| R19 | 020239 | RES | WW | 5.0005 | K | .1% | 1/8 | W | JORDAN J-11 |
| R20 | 040052 | RES | VARI | 50 | OHM | 10% | 1.5 | W | CTS 110 |
| R21 | 000202 | RES | CARBON | 2 | K | 5% | 1/4 | W1 | OHMITE RC07GF202J |
| R22 | 020240 | RES | WW | 500 | OHM | .1% | 1/8 | W | JORDAN J-11 |
| R23 | 040051 | RES | VARI | 5 | OHM | 10% | 1.5 | W | CTS 110 |
| R24 | 000163 | RES | CARBON | 16 | K | 5% | 1/4 | W1 | OHMITE RC07GF163J |
| R25 | 000163 | RES | CARBON | 16 | K | 5% | 1/4 | W1 | OHMITE RC07GF163J |
| R26 | 000101 | RES | CARBON | 100 | OHM | 5% | 1/4 | W1 | OHMITE RC07GF101J |
| R27 | 000912 | RES | CARBON | 9.1 | K | 5% | 1/4 | W1 | OHMITE RC07GF912J |
| R28 | 000100 | RES | CARBON | 10 | OHM | 5% | 1/4 | W1 | OHMITE RC07GF100J |

# PARTS LIST

ASSEMBLY 400706 PC Board Assy-AC Converter A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CR01 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR02 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR03 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR04 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR05 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR06 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR07 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR08 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR09 | 220004 | DIODE SILICO | ZENER 1N961B | | 1 | MOTOROLA | 1N961B | |
| CR10 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR11 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| CR12 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR13 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR14 | 210004 | DIODE SILICO | SD4 | | | DIODES IN SD4 | | |
| CR15 | 211083 | DIODE SILICO | 018 | | 1 | DANA | 211083 | |
| C01 | 130033 | CAP GLASS | 6.8 PFD | 500 V | 10%1 | CORN | CYFN-10C6R8 | |
| C02 | 130029 | CAP GLASS | 1-5 PFD | 500 V | 10% | LRC | 682116 | |
| C03 | 110017 | CAP TANTA | 1 MFD | 35 V | 10%1 | KEMET | K1C35K | |
| C04 | 110038 | CAP ELECT | 50 MFD | 15 V | 20% | DUCATI | 50-15 | |
| C05 | 110001 | CAP TANTA | 6.8 MFD | 35 V | 10%1 | KEMET | K6R8C35K | |
| C06 | 101641 | CAP CERAM | 470 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C07 | 130039 | CAP GLASS | 27 PFD | 500 V | 10% | CORN | CYFM10C270J | |
| C08 | 130029 | CAP GLASS | 1-5 PFD | 500 V | 10% | LRC | 682116 | |
| C09 | 100006 | CAP CERAM | 10 PFD | 500 V | 10%1 | AEROVOX | TCD-N750 | |
| C10 | 130034 | CAP CERAM | 7-45 PFD | 500 V | 10% | CRL | 822BN-N650 | |
| C11 | 130040 | CAP GLASS | 240 PFD | 300 V | 10% | CORN | CYFM10C241J | |
| C13 | 130041 | CAP GLASS | 3000 PFD | 500 V | 10% | CORN | CYFM200302J | |
| C14 | 100006 | CAP CERAM | 10 PFD | 500 V | 10%1 | AEROVOX | TCD-N750 | |
| C15 | 101641 | CAP CERAM | 470 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C16 | 110001 | CAP TANTA | 6.8 MFD | 35 V | 10%1 | KEMET | K6R8C35K | |
| C17 | 100005 | CAP CERAM | 22 PFD | 500 V | 10% | AEROVOX | TCD-N750 | |
| C18 | 110001 | CAP TANTA | 6.8 MFD | 35 V | 10%1 | KEMET | K6R8C35K | |
| C19 | 110002 | CAP TANTA | 22 MFD | 35 V | 10%1 | KEMET | K22C35K | |
| C20 | 110001 | CAP TANTA | 6.8 MFD | 35 V | 10%1 | KEMET | K6R8C35K | |
| C21 | 120069 | CAP MYLAR | .39 MFD | 100 V | 10% | IMB | XA1134K | |
| C22 | 130034 | CAP CERAM | 7-45 PFD | 500 V | 10% | CRL | 822BN-N650 | |
| K01 | 310013 | RELAY REED | SPST | 24V | 1 | WHEELOCK | 2961A X6 | |
| K02 | 310013 | RELAY REED | SPST | 24V | 1 | WHEELOCK | 2961A X6 | |

PARTS LIST

ASSEMBLY 400706 PC Board Assy-AC Converter A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| K03 | 310022 | RELAY DC | | 4 PDT | 29V | | | ALLIED | TS154-OC-CC |
| Q01 | 200035 | TRANS SILICO NPN | | 014 | | | | DANA | 200035 |
| Q02 | 200035 | TRANS SILICO NPN | | 014 | | | | DANA | 200035 |
| Q03 | 200035 | TRANS SILICO NPN | | 014 | | | | DANA | 200035 |
| Q04 | 200043 | TRANS SILICO NPN | | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q05 | 200043 | TRANS SILICO NPN | | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q06 | 200043 | TRANS SILICO NPN | | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q07 | 200043 | TRANS SILICO NPN | | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q08 | 200043 | TRANS SILICO NPN | | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q09 | 200011 | TRANS SILICO PNP | | 009 | | | | DANA | 200011 |
| Q10 | 200035 | TRANS SILICO NPN | | 014 | | | | DANA | 200035 |
| R01 | 000473 | RES | CARBON | 47 K | 5% | 1/4 W1 | | OHMITE | RC07GF473J |
| R02 | 010280 | RES | METAL | MATCH SET | | | | DANA | 010280 |
| R03 | 000473 | RES | CARBON | 47 K | 5% | 1/4 W1 | | OHMITE | RC07GF473J |
| R04 | 000684 | RES | CARBON | 680 K | 5% | 1/4 W | | OHMITE | RC07GF684J |
| R05 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF101J |
| R06 | 000913 | RES | CARBON | 91 K | 5% | 1/4 W | | OHMITE | RC07GF913J |
| R07 | 000470 | RES | CARBON | 47 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF470J |
| R08 | 000682 | RES | CARBON | 6.8 K | 5% | 1/4 W1 | | OHMITE | RC07GF682J |
| R09 | 000272 | RES | CARBON | 2.7 K | 5% | 1/4 W | | OHMITE | RC07GF272J |
| R10 | 000201 | RES | CARBON | 200 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF201J |
| R11 | 010280 | RES | METAL | MATCH SET | | | | DANA | 010280 |
| R12 | 000913 | RES | CARBON | 91 K | 5% | 1/4 W | | OHMITE | RC07GF913J |
| R13 | 010280 | RES | METAL | MATCH SET | | | | DANA | 010280 |
| R14 | 010280 | RES | METAL | MATCH SET | | | | DANA | 010280 |
| R15 | 000152 | RES | CARBON | 1.5 K | 5% | 1/4 W1 | | OHMITE | RC07GF152J |
| R16 | 000201 | RES | CARBON | 200 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF201J |
| R17 | 000392 | RES | CARBON | 0003.9 K | 5% | 1/4 W1 | | OHMITE | RC07GF392J |
| R18 | 040053 | RES | VARI | 5 K | 10% | 1.5 W | | CTS | 110 |
| R19 | 040062 | RES | VARI | 500 OHM | 10% | 1.5 W | | CTS | 110 |
| R20 | 040052 | RES | VARI | 50 OHM | 10% | 1.5 W | | CTS | 110 |
| R21 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | | OHMITE | RC07GF153J |
| R22 | 000330 | RES | CARBON | 33 K | 5% | 1/4 W | | OHMITE | RC07GF330J |
| R23 | 000751 | RES | CARBON | 750 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF751J |
| R24 | 000330 | RES | CARBON | 33 K | 5% | 1/4 W | | OHMITE | RC07GF330J |
| R25 | 000432 | RES | CARBON | 4.3 K | 5% | 1/4 W1 | | OHMITE | RC07GF432J |
| R26 | 000103 | RES | CARBON | 10 K | 5% | 1/4 W1 | | OHMITE | RC07GF103J |
| R27 | 000910 | RES | CARBON | 91 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF910J |

PARTS LIST

ASSEMBLY 400706 PC Board Assy - AC Converter, 030 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R28 | 000390 | RES | CARBON | 39 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF390J |
| R29 | 020165 | RES | WW | 270 | K | 1% | 1/8 W | KELVIN | EP-20 |
| R30 | 020165 | RES | WW | 270 | K | 1% | 1/8 W | KELVIN | EP-20 |
| R31 | 020164 | RES | WW | 135 | K | .1% | 1/8 W | KELVIN | EP-20 |
| R32 | 020164 | RES | WW | 135 | K | .1% | 1/8 W | KELVIN | EP-20 |
| R33 | 000202 | RES | CARBON | 2 | K | 5% | 1/4 W1 | OHMITE | RC07GF202J |
| R34 | 001705 | RES | CARBON | 820 | OHM | 5% | 1/2 W | OHMITE | RC20GF821J |
| R35 | 000152 | RES | CARBON | 1.5 | K | 5% | 1/4 W1 | OHMITE | RC07GF152J |

PARTS LIST

ASSEMBLY 402383 **P.C. BOARD ASSY-AC CONVERTER, MOD 29**

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | |
|---|---|---|---|---|---|---|---|
| CR05 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR06 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR07 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR08 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR09 | 220004 | DIODE SILICO ZENER 1N961B | | 1 | MOTOROLA | 1N961B | |
| CR10 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR11 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR12 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR13 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR14 | 210004 | DIODE SILICO | SD4 | | DIODES IN SD4 | | |
| CR15 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR16 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR17 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR18 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR19 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR20 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR21 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR22 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR23 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR24 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| CR25 | 211083 | DIODE SILICO | 018 | 1 | DANA | 211083 | |
| C01 | 130027 | CAP GLASS | 10 PFD 500 V | 10% | CORN | CYFM-10C100 | |
| C02 | 130029 | CAP GLASS | 1-5 PFD 500 V | 10% | LRC | 682116 | |
| C03 | 120055 | CAP MYLAR | 1.0 MFD 100 V | 10%1 | IMB | XA2B105K | |
| C04 | 110038 | CAP ELECT | 50 MFD 15 V | 20% | DUCATI | 50-15 | |
| C05 | 130047 | CAP GLASS | 33 PFD 500 V | 5% | CORN | CYFM10C330J | |
| C06 | 101641 | CAP CERAM | 470 PFD 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C07 | 130042 | CAP GLASS | 2.7 PFD 500 V | 10% | CORN | CYFM10C2R7 | |
| C08 | 130029 | CAP GLASS | 1-5 PFD 500 V | 10% | LRC | 682116 | |
| C09 | 100006 | CAP CERAM | 10 PFD 500 V | 10%1 | AEROVOX | TCD-N750 | |
| C11 | 130059 | CAP GLASS | 30 PFD | 10% | CORNING | CY10C300J | |
| C12 | 130029 | CAP GLASS | 1-5 PFD 500 V | 10% | LRC | 682116 | |
| C13 | 130048 | CAP GLASS | 3900 PFD 500 V | 5% | CORN | CYFM20C392J | |
| C14 | 100006 | CAP CERAM | 10 PFD 500 V | 10%1 | AEROVOX | TCD-N750 | |
| C15 | 101641 | CAP CERAM | 470 PFD 500 V | 10%1 | AEROVOX | SCD1X5F | |
| C16 | 110001 | CAP TANTA | 6.8 MFD 35 V | 10%1 | KEMET | K6R8C35K | |
| C17 | 100005 | CAP CERAM | 22 PFD 500 V | 10% | AEROVOX | TCD-N750 | |
| C18 | 110001 | CAP TANTA | 6.8 MFD 35 V | 10%1 | KEMET | K6R8C35K | |

PARTS LIST

ASSEMBLY 402383 **P.C. BOARD ASSY-AC CONVERTER, MOD29**

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C19 | 110002 | CAP | TANTA | 22 MFD | 35 V | 10%1 | | KEMET | K22C35K |
| C20 | 110001 | CAP | TANTA | 6.8 MFD | 35 V | 10%1 | | KEMET | K6R8C35K |
| C21 | 120069 | CAP | MYLAR | .39 MFD | 100 V | 10% | | IMB | XA1134K |
| C22 | 130053 | CAP | CERAM | 5-60 PFD | | | | AMPEREX | C010GA/60E |
| C23 | 130019 | CAP | GLASS | 330 PFD | 500 V | 10% | | CORN | CYFM15C331K |
| C24 | 130053 | CAP | CERAM | 5-60 PFD | | | | AMPEREX | C010GA/60E |
| C26 | 130042 | CAP | GLASS | 2.7 PFD | 500 V | 10% | | CORN | CYFM10C2R7 |
| K01 | 310013 | RELAY | REED | SPST | 24V | | 1 | WHEELOCK | 2961A X6 |
| K02 | 310013 | RELAY | REED | SPST | 24V | | 1 | WHEELOCK | 2961A X6 |
| K03 | 310022 | RELAY | DC | 4 PDT | 29V | | | ALLIED | TS154-0C-CC |
| K04 | 310013 | RELAY | REED | SPST | 24V | | 1 | WHEELOCK | 2961A X6 |
| Q03 | 200035 | TRANS | SILICO NPN | 014 | | | | DANA | 200035 |
| Q04 | 200068 | TRANS | | 2N4250 | | | | FAIRCHILD | 2N4250 |
| Q05 | 200043 | TRANS | SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q06 | 200043 | TRANS | SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q07 | 200043 | TRANS | SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q08 | 200043 | TRANS | SILICO NPN | 2N3565 | | | | FAIRCHILD | 2N3565 |
| Q09 | 200011 | TRANS | SILICO PNP | 009 | | | | DANA | 200011 |
| Q10 | 200035 | TRANS | SILICO NPN | 014 | | | | DANA | 200035 |
| Q11 | 200035 | TRANS | SILICO NPN | 014 | | | | DANA | 200035 |
| Q12 | 200035 | TRANS | SILICO NPN | 014 | | | | DANA | 200035 |
| Q13 | 200035 | TRANS | SILICO NPN | 014 | | | | DANA | 200035 |
| R02 | 010340 | RES | METAL | MATCH SET | | | | DANA | 010340 |
| R04 | 000683 | RES | CARBON | 68 K | 5% | 1/4 W1 | | OHMITE | RC07GF683J |
| R05 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF101J |
| R06 | 010340 | RES | METAL | MATCH SET | | | | DANA | 010340 |
| R07 | 000470 | RES | CARBON | 47 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF470J |
| R08 | 000682 | RES | CARBON | 6.8 K | 5% | 1/4 W1 | | OHMITE | RC07GF682J |
| R09 | 000272 | RES | CARBON | 2.7 K | 5% | 1/4 W | | OHMITE | RC07GF272J |
| R10 | 000201 | RES | CARBON | 200 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF201J |
| R11 | 040054 | RES | VARI | 50 K | 10% | 1/5 W | | BOURNS | 3068-P-1503 |
| R12 | 010340 | RES | METAL | MATCH SET | | | | DANA | 010340 |
| R13 | 040053 | RES | VARI | 5 K | 10% | 1.5 W | | CTS | 110 |
| R14 | 010340 | RES | METAL | MATCH SET | | | | DANA | 010340 |
| R15 | 000152 | RES | CARBON | 1.5 K | 5% | 1/4 W1 | | OHMITE | RC07GF152J |
| R16 | 000201 | RES | CARBON | 200 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF201J |
| R17 | 000392 | RES | CARBON | 0003.9 K | 5% | 1/4 W1 | | OHMITE | RC07GF392J |
| R18 | 010340 | RES | METAL | MATCH SET | | | | DANA | 010340 |

PARTS LIST

ASSEMBLY 402383 **P.C. BOARD ASSY-AC CONVERTER, MOD 29**

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R19 | 040062 | RES | VARI | 500 | OHM | 10% | 1.5 W | CTS | 110 |
| R20 | 040052 | RES | VARI | 50 | OHM | 10% | 1.5 W | CTS | 110 |
| R21 | 000153 | RES | CARBON | 15 | K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R22 | 000330 | RES | CARBON | 33 | K | 5% | 1/4 W | OHMITE | RC07GF330J |
| R23 | 000751 | RES | CARBON | 750 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF751J |
| R24 | 000330 | RES | CARBON | 33 | K | 5% | 1/4 W | OHMITE | RC07GF330J |
| R25 | 000432 | RES | CARBON | 4.3 | K | 5% | 1/4 W1 | OHMITE | RC07GF432J |
| R26 | 000103 | RES | CARBON | 10 | K | 5% | 1/4 W1 | OHMITE | RC07GF103J |
| R27 | 000910 | RES | CARBON | 91 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF910J |
| R28 | 000390 | RES | CARBON | 39 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF390J |
| R29 | 020165 | RES | WW | 270 | K | 1% | 1/8 W | KELVIN | EP-20 |
| R30 | 020165 | RES | WW | 270 | K | 1% | 1/8 W | KELVIN | EP-20 |
| R31 | 020164 | RES | WW | 135 | K | .1% | 1/8 W | KELVIN | EP-20 |
| R32 | 020164 | RES | WW | 135 | K | .1% | 1/8 W | KELVIN | EP-20 |
| R33 | 000202 | RES | CARBON | 2 | K | 5% | 1/4 W1 | OHMITE | RC07GF202J |
| R34 | 001705 | RES | CARBON | 820 | OHM | 5% | 1/2 W | OHMITE | RC20GF821J |
| R39 | 000152 | RES | CARBON | 1.5 | K | 5% | 1/4 W1 | OHMITE | RC07GF152J |
| R40 | 000243 | RES | CARBON | 24 | K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R41 | 000243 | RES | CARBON | 24 | K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R42 | 000243 | RES | CARBON | 24 | K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R43 | 000243 | RES | CARBON | 24 | K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R44 | 000304 | RES | CARBON | 300 | K | 5% | 1/4 W | OHMITE | RC07GF304J |
| R45 | 000473 | RES | CARBON | 47 | K | 5% | 1/4 W1 | OHMITE | RC07GF473J |
| R46 | 000243 | RES | CARBON | 24 | K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R47 | 000243 | RES | CARBON | 24 | K | 5% | 1/4 W1 | OHMITE | RC07GF243J |
| R48 | 000304 | RES | CARBON | 300 | K | 5% | 1/4 W | OHMITE | RC07GF304J |
| R49 | 000336 | RES | CARBON | 33 | M | 5% | 1/4 W1 | OHMITE | RC07GF336J |
| R50 | 000104 | RES | CARBON | 100 | K | 5% | 1/4 W1 | OHMITE | RC07GF104J |

PARTS LIST

ASSEMBLY 400700 PC Board Assy - Isolator A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CR01 | 200048 | TRANS SILICO NPN DUAL 2N3565 | | | | | | DANA | 200048 |
| CR02 | 211236 | DIODE SILICO | | | 007 | | | DANA | 211236 |
| CR03 | 211236 | DIODE SILICO | | | 007 | | | DANA | 211236 |
| CR04 | 211236 | DIODE SILICO | | | 007 | | | DANA | 211236 |
| CR05 | 211083 | DIODE SILICO | | | 018 | 1 | | DANA | 211083 |
| CR06 | 220012 | DIODE SILICO ZENER | | | 1N958B | 1 | | MOTOROLA | 1N958B |
| CR07 | 211083 | DIODE SILICO | | | 018 | 1 | | DANA | 211083 |
| CR08 | 211083 | DIODE SILICO | | | 018 | 1 | | DANA | 211083 |
| CR09 | 220012 | DIODE SILICO ZENER | | | 1N958B | 1 | | MOTOROLA | 1N958B |
| CR10 | 211083 | DIODE SILICO | | | 018 | 1 | | DANA | 211083 |
| CR15 | 211083 | DIODE SILICO | | | 018 | 1 | | DANA | 211083 |
| CR16 | 210004 | DIODE SILICO | | | SD4 | | DIODES IN SD4 | | |
| CR17 | 210004 | DIODE SILICO | | | SD4 | | DIODES IN SD4 | | |
| CR18 | 220012 | DIODE SILICO ZENER | | | 1N958B | 1 | | MOTOROLA | 1N958B |
| C01 | 120108 | | | | | | | | |
| C02 | 121146 | CAP | MYLAR | .0047 MFD | 100 V | 10%1 | | CDE | WMF1D47 |
| C03 | 120083 | CAP | MYLAR | 6.7 MFD | 100 V | 5% | | IMB | XA2B675J |
| C04 | 120005 | CAP | MYLAR | .001 MFD | 100 V | 10%1 | | | WMF1D1 |
| C05 | 120003 | CAP | MYLAR | .1 MFD | 100 V | 10%1 | | CDE | WMF1P1 |
| C06 | 110038 | CAP | ELECT | 50 MFD | 15 V | 20% | | DUCATI | 50-15 |
| | | CAP | POLY | 750 PFD | 500 V | | | CENTRALAB | CPR-750J |
| C07 | 120003 | CAP | MYLAR | .1 MFD | 100 V | 10%1 | | CDE | WMF1P1 |
| C08 | 110039 | CAP | ELECT | 5 MFD | 50 V | 20% | | DUCATI | 5-50 |
| C09 | 110038 | CAP | ELECT | 50 MFD | 15 V | 20% | | DUCATI | 50-15 |
| C10 | 110036 | CAP | ELECT | 25 MFD | 50 V | 20% | | DUCATI | 25-50 |
| C11 | 110036 | CAP | ELECT | 25 MFD | 50 V | 20% | | DUCATI | 25-50 |
| C12 | 100013 | CAP | CERAM | 15 PFD | 500 V | 10% | | AEROVOX | TCD-N750 |
| C13 | 101145 | CAP | CERAM | 100 PFD | 500 V | 10%1 | | AEROVOX | SCD1X5F |
| C14 | 121088 | CAP | MYLAR | .01 MFD | 100 V | 10% | | CDE | WMF1S1 |
| C15 | 101145 | CAP | CERAM | 100 PFD | 500 V | 10%1 | | AEROVOX | SCD1X5F |
| Q01 | 200027 | TRANS SILICO | | | FSV | | | DANA | 200027 |
| Q02 | 200063 | TRANS SILICO NPN | | | 016 | | | DANA | 200063 |
| Q03 | 201084 | TRANS GERMAN PNP | | | 2N1304 | 1 | | TI | 2N1304 |
| Q04 | 200063 | TRANS SILICO NPN | | | 016 | | | DANA | 200063 |
| Q05 | 200044 | TRANS SILICO NPN DUAL | | | FSV | | | DANA | 200044 |
| Q06 | 200044 | TRANS SILICO NPN DUAL | | | FSV | | | DANA | 200044 |
| Q07 | 200022 | TRANS SILICO PNP | | | 012 | | | DANA | 200022 |
| Q08 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q09 | 200035 | TRANS SILICO NPN | | | 014 | | | DANA | 200035 |

PARTS LIST

ASSEMBLY 400700 PC Board Assy-Isolator A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Q10 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q11 | 200011 | TRANS SILICO PNP | | | 009 | | | DANA | 200011 |
| Q12 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q13 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q14 | 200022 | TRANS SILICO PNP | | | 012 | | | DANA | 200022 |
| Q15 | 200035 | TRANS SILICO NPN | | | 014 | | | DANA | 200035 |
| Q16 | 200035 | TRANS SILICO NPN | | | 014 | | | DANA | 200035 |
| R01 | 010249 | RES | WW | 25 M | 2% | 1/8 W | | DALE | DC-2 |
| R02 | 000623 | RES | CARBON | 62 K | 5% | 1/4 W1 | | OHMITE | RC07GF623J |
| R03 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF101J |
| R04 | 000122 | RES | CARBON | 1.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF122J |
| R05 | 000622 | RES | CARBON | 6.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF622J |
| R06 | 040050 | RES | VARI | 5 K | 10% | 1/2 W | | BOURNS | 3067-P-1-K0 |
| R07 | 000122 | RES | CARBON | 1.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF122J |
| R08 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF101J |
| R09 | 000242 | RES | CARBON | 2.4 K | 5% | 1/4 W1 | | OHMITE | RC07GF242J |
| R10 | 010308 | RES | METAL | 49.9 OHM | 1% | 1/4 W | | ELECTRA | RN60DT-0 |
| R11 | 001737 | RES | FSV | | 5% | 1/4 W | | DANA | 001737 |
| R12 | 011178 | RES | METAL | 4.99 K | 1% | 1/4 W | | ELECTRA | RN20X4994F |
| R13 | 040055 | RES | VARI | 500 K | 10% | 1/5 W | | BOURNS | 3068-P-1-50 |
| R14 | 000335 | RES | CARBON | 3.3 M | 5% | 1/4 W1 | | OHMITE | RC07GF335J |
| R15 | 040057 | RES | VARI | 250 K | 20% | 1/4 W | | CTS | 45 |
| R16 | 011178 | RES | METAL | 4.99 K | 1% | 1/4 W | | ELECTRA | RN20X4994F |
| R17 | 040053 | RES | VARI | 5 K | 10% | 1.5 W | | CTS | 110 |
| R18 | 000752 | RES | CARBON | 7.5 K | 5% | 1/4 W1 | | OHMITE | RC07GF752J |
| R20 | 000102 | RES | CARBON | 1 K | 5% | 1/4 W1 | | OHMITE | RC07GF102J |
| R21 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | | OHMITE | RC07GF912J |
| R22 | 000303 | RES | CARBON | 30 K | 5% | 1/4 W1 | | OHMITE | RC07GF303J |
| R23 | 000335 | RES | CARBON | 3.3 M | 5% | 1/4 W1 | | OHMITE | RC07GF335J |
| R24 | 000102 | RES | CARBON | 1 K | 5% | 1/4 W1 | | OHMITE | RC07GF102J |
| R25 | 000433 | RES | CARBON | 43 K | 5% | 1/4 W | | OHMITE | RC07GF433J |
| R26 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | | OHMITE | RC07GF153J |
| R27 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | | OHMITE | RC07GF912J |
| R28 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | | OHMITE | RC07GF912J |
| R29 | 000240 | RES | CARBON | 24 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF240J |
| R30 | 000750 | RES | CARBON | 75 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF750J |
| R31 | 000122 | RES | CARBON | 1.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF122J |
| R32 | 000513 | RES | CARBON | 51 K | 5% | 1/4 W1 | | OHMITE | RC07GF513J |

PARTS LIST

ASSEMBLY 400700 PC Board Assy - Isolator A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R33 | 000332 | RES | CARBON | 3.3 K | 5% | 1/4 W1 | OHMITE | RC07GF332J |
| R34 | 000511 | RES | CARBON | 510 OHM | 5% | 1/4 W1 | OHMITE | RC07GF511J |
| R35 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | OHMITE | RC07GF101J |
| R36 | 000240 | RES | CARBON | 24 OHM | 5% | 1/4 W1 | OHMITE | RC07GF240J |
| R37 | 000565 | RES | CARBON | 5.6 M | 5% | 1/4 W1 | OHMITE | RC07GF565J |
| R38 | 000136 | RES | CARBON | 13 M | 5% | 1/4 W | OHMITE | RC07GF136J |
| R39 | 000132 | RES | CARBON | 1.3 K | 5% | 1/4 W | OHMITE | RC07GF132J |
| R40 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R41 | 000472 | RES | CARBON | 4.7 K | 5% | 1/4 W1 | OHMITE | RC07GF472J |
| R42 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | OHMITE | RC07GF101J |
| R43 | 001737 | RES | FSV | | 5% | 1/4 W | DANA | 001737 |

# PARTS LIST

ASSEMBLY 402796 PC Board Assy-Isolator, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CR01 | 200048 | TRANS SILICO NPN DUAL 2N3565 | | | | | DANA | 200048 |
| CR02 | 200048 | TRANS SILICO NPN DUAL 2N3565 | | | | | DANA | 200048 |
| CR03 | 211236 | DIODE SILICO 007 | | | | | DANA | 211236 |
| CR04 | 211236 | DIODE SILICO 007 | | | | | DANA | 211236 |
| CR05 | 211083 | DIODE SILICO 018 | | | | 1 | DANA | 211083 |
| CR06 | 220012 | DIODE SILICO ZENER 1N958B | | | | 1 | MOTOROLA | 1N958B |
| CR07 | 211083 | DIODE SILICO 018 | | | | 1 | DANA | 211083 |
| CR08 | 211083 | DIODE SILICO 018 | | | | 1 | DANA | 211083 |
| CR09 | 220012 | DIODE SILICO ZENER 1N958B | | | | 1 | MOTOROLA | 1N958B |
| CR10 | 211083 | DIODE SILICO 018 | | | | 1 | DANA | 211083 |
| CR15 | 211083 | DIODE SILICO 018 | | | | 1 | DANA | 211083 |
| CR16 | 210004 | DIODE SILICO SD4 | | | | | DIODES IN SD4 | |
| CR17 | 210004 | DIODE SILICO SD4 | | | | | DIODES IN SD4 | |
| CR18 | 220012 | DIODE SILICO ZENER 1N958B | | | | 1 | MOTOROLA | 1N958B |
| C01 | 120108 | CAP POLY 750 PFD 500V | | | | | CENTRALAB | PR-750J |
| C02 | 121146 | CAP | MYLAR | .0047 MFD | 100 V | 10%1 | CDE | WMF1D47 |
| C03 | 120063 | CAP | MYLAR | 2 MFD | 100 V | 5%1 | IMB | XT2B205J |
| C04 | 120005 | CAP | MYLAR | .001 MFD | 100 V | 10%1 | | WMF1D1 |
| C05 | 120003 | CAP | MYLAR | .1 MFD | 100 V | 10%1 | CDE | WMF1P1 |
| C06 | 110038 | CAP | ELECT | 50 MFD | 15 V | 20% | DUCATI | 50-15 |
| C07 | 120003 | CAP | MYLAR | .1 MFD | 100 V | 10%1 | CDE | WMF1P1 |
| C08 | 110039 | CAP | ELECT | 5 MFD | 50 V | 20% | DUCATI | 5-50 |
| C09 | 110038 | CAP | ELECT | 50 MFD | 15 V | 20% | DUCATI | 50-15 |
| C10 | 110036 | CAP | ELECT | 25 MFD | 50 V | 20% | DUCATI | 25-50 |
| C11 | 110036 | CAP | ELECT | 25 MFD | 50 V | 20% | DUCATI | 25-50 |
| C12 | 100013 | CAP | CERAM | 15 PFD | 500 V | 10% | AEROVOX | TCD-N750 |
| C13 | 101145 | CAP | CERAM | 100 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F |
| C14 | 121088 | CAP | MYLAR | .01 MFD | 100 V | 10% | CDE | WMF1S1 |
| C15 | 101145 | CAP | CERAM | 100 PFD | 500 V | 10%1 | AEROVOX | SCD1X5F |
| Q01 | 200027 | TRANS SILICO FSV | | | | | DANA | 200027 |
| Q02 | 200063 | TRANS SILICO NPN 016 | | | | | DANA | 200063 |
| Q03 | 201084 | TRANS GERMAN PNP 2N1304 | | | | 1 | TI | 2N1304 |
| Q04 | 200063 | TRANS SILICO NPN 016 | | | | | DANA | 200063 |
| Q05 | 200044 | TRANS SILICO NPN DUAL FSV | | | | | DANA | 200044 |
| Q06 | 200044 | TRANS SILICO NPN DUAL FSV | | | | | DANA | 200044 |
| Q07 | 200022 | TRANS SILICO PNP 012 | | | | | DANA | 200022 |
| Q08 | 200043 | TRANS SILICO NPN 2N3565 | | | | | FAIRCHILD | 2N3565 |
| Q09 | 200035 | TRANS SILICO NPN 014 | | | | | DANA | 200035 |

PARTS LIST

ASSEMBLY 402796 PC Board Assy-Isolator, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Q10 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q11 | 200011 | TRANS SILICO PNP | | | 009 | | | DANA | 200011 |
| Q12 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q13 | 200043 | TRANS SILICO NPN | | | 2N3565 | | | FAIRCHILD | 2N3565 |
| Q14 | 200022 | TRANS SILICO PNP | | | 012 | | | DANA | 200022 |
| Q15 | 200035 | TRANS SILICO NPN | | | 014 | | | DANA | 200035 |
| Q16 | 200035 | TRANS SILICO NPN | | | 014 | | | DANA | 200035 |
| R01 | 010249 | RES | WW | 25 M | 2% | 1/8 W | | DALE | DC-2 |
| R02 | 000623 | RES | CARBON | 62 K | 5% | 1/4 W1 | | OHMITE | RC07GF623J |
| R03 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF101J |
| R04 | 000122 | RES | CARBON | 1.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF122J |
| R05 | 000622 | RES | CARBON | 6.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF622J |
| R06 | 040050 | RES | VARI | 5 K | 10% | 1/2 W | | BOURNS | 3067-P-1-K0 |
| R07 | 000122 | RES | CARBON | 1.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF122J |
| R08 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF101J |
| R09 | 000242 | RES | CARBON | 2.4 K | 5% | 1/4 W1 | | OHMITE | RC07GF242J |
| R10 | 010368 | RES | METAL | 49.9 OHM | 1% | 1/4 W | | ELECTRA | RN60DT-0 |
| R11 | 001737 | RES | FSV | | 5% | 1/4 W | | DANA | 001737 |
| R12 | 011178 | RES | METAL | 4.99 K | 1% | 1/4 W | | ELECTRA | RN20X4994F |
| R13 | 040055 | RES | VARI | 500 K | 10% | 1/5 W | | BOURNS | 3068-P-1-50 |
| R14 | 000335 | RES | CARBON | 3.3 M | 5% | 1/4 W1 | | OHMITE | RC07GF335J |
| R15 | 040057 | RES | VARI | 250 K | 20% | 1/4 W | | CTS | 45 |
| R16 | 011178 | RES | METAL | 4.99 K | 1% | 1/4 W | | ELECTRA | RN20X4994F |
| R17 | 040053 | RES | VARI | 5 K | 10% | 1.5 W | | CTS | 110 |
| R18 | 000752 | RES | CARBON | 7.5 K | 5% | 1/4 W1 | | OHMITE | RC07GF752J |
| R20 | 000102 | RES | CARBON | 1 K | 5% | 1/4 W1 | | OHMITE | RC07GF102J |
| R21 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | | OHMITE | RC07GF912J |
| R22 | 000393 | RES | CARBON | 39 K | 5% | 1/4 W | | OHMITE | RC07GF393J |
| R23 | 000335 | RES | CARBON | 3.3 M | 5% | 1/4 W1 | | OHMITE | RC07GF335J |
| R24 | 000102 | RES | CARBON | 1 K | 5% | 1/4 W1 | | OHMITE | RC07GF102J |
| R25 | 000433 | RES | CARBON | 43 K | 5% | 1/4 W | | OHMITE | RC07GF433J |
| R26 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | | OHMITE | RC07GF153J |
| R27 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | | OHMITE | RC07GF912J |
| R28 | 000912 | RES | CARBON | 9.1 K | 5% | 1/4 W1 | | OHMITE | RC07GF912J |
| R29 | 000240 | RES | CARBON | 24 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF240J |
| R30 | 000750 | RES | CARBON | 75 OHM | 5% | 1/4 W1 | | OHMITE | RC07GF750J |
| R31 | 000122 | RES | CARBON | 1.2 K | 5% | 1/4 W1 | | OHMITE | RC07GF122J |
| R32 | 000513 | RES | CARBON | 51 K | 5% | 1/4 W1 | | OHMITE | RC07GF513J |

PARTS LIST

ASSEMBLY 402796 PC Board Assy-Isolator, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R33 | 000332 | RES | CARBON | 3.3 K | 5% | 1/4 W1 | OHMITE | RC07GF332J | |
| R34 | 000511 | RES | CARBON | 510 OHM | 5% | 1/4 W1 | OHMITE | RC07GF511J | |
| R35 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | OHMITE | RC07GF101J | |
| R36 | 000240 | RES | CARBON | 24 OHM | 5% | 1/4 W1 | OHMITE | RC07GF240J | |
| R37 | 000565 | RES | CARBON | 5.6 M | 5% | 1/4 W1 | OHMITE | RC07GF565J | |
| R38 | 000136 | RES | CARBON | 13 M | 5% | 1/4 W | OHMITE | RC07GF136J | |
| R39 | 000132 | RES | CARBON | 1.3 K | 5% | 1/4 W | OHMITE | RC07GF132J | |
| R40 | 000153 | RES | CARBON | 15 K | 5% | 1/4 W1 | OHMITE | RC07GF153J | |
| R41 | 000472 | RES | CARBON | 4.7 K | 5% | 1/4 W1 | OHMITE | RC07GF472J | |
| R42 | 000101 | RES | CARBON | 100 OHM | 5% | 1/4 W1 | OHMITE | RC07GF101J | |
| R43 | 001737 | RES | FSV | | 5% | 1/4 W | DANA | 001737 | |
| R44 | 001737 | RES | FSV | | 5% | 1/4 W | DANA | 001737 | |

# PARTS LIST

ASSEMBLY 402983 PC Board Assy-Isolator, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION |
|---|---|---|
| CR01 | 200048 | TRANS SILICO NPN DUAL 2N3565 DANA 200048 |
| CR02 | 200048 | TRANS SILICO NPN DUAL 2N3565 DANA 200048 |
| CR03 | 211236 | DIODE SILICO 007 DANA 211236 |
| CR04 | 211236 | DIODE SILICO 007 DANA 211236 |
| CR05 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR06 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR07 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR08 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR09 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR10 | 210004 | DIODE SILICO SD4 DIODES IN SD4 |
| CR11 | 210004 | DIODE SILICO SD4 DIODES IN SD4 |
| CR12 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR13 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR14 | 221177 | DIODE SILICO ZENER 1/4 W1 MOTOROLA M.2.4A25 |
| CR15 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR16 | 211083 | DIODE SILICO 018 1 DANA 211083 |
| CR17 | 220012 | DIODE SILICO ZENER 1N958B 1 MOTOROLA 1N958B |
| CR18 | 220012 | DIODE SILICO ZENER 1N958B 1 MOTOROLA 1N958B |
| C01 | 120108 | CAP POLY 750 PFD 500 V CENTRALAB PR-750J |
| C02 | 120063 | CAP MYLAR 2 MFD 100 V 5%1 IMB XT2B205J |
| C03 | 100006 | CAP CERAM 10 PFD 500 V 10%1 AEROVOX TCD-N750 |
| C04 | 121146 | CAP MYLAR .0047 MFD 100 V 10%1 CDE WMF1D47 |
| C05 | 110039 | CAP ELECT 5 MFD 50 V 20% DUCATI 5-50 |
| C06 | 121088 | CAP MYLAR .01 MFD 100 V 10% CDE WMF1S1 |
| C07 | 120001 | CAP MYLAR .0033 MFD 100 V 10%1 CDE WMF1D33 |
| C08 | 101145 | CAP CERAM 100 PFD 500 V 10%1 AEROVOX SCD1X5F |
| C09 | 120003 | CAP MYLAR .1 MFD 100 V 10%1 CDE WMF1P1 |
| C10 | 100013 | CAP CERAM 15 PFD 500 V 10% AEROVOX TCD-N750 |
| C11 | 110036 | CAP ELECT 25 MFD 50 V 20% DUCATI 25-50 |
| C12 | 110036 | CAP ELECT 25 MFD 50 V 20% DUCATI 25-50 |
| C13 | 101182 | CAP CERAM 47 PFD 500 V 10%1 AEROVOX TCD-N750 |
| C14 | 110038 | CAP ELECT 50 MFD 15 V 20% DUCATI 50-15 |
| C15 | 120173 | CAP MYLAR .1 MFD 100V IMB XVB104J |
| C16 | 110038 | CAP ELECT 50 MFD 15 V 20% DUCATI 50-15 |
| Q01 | 200027 | TRANS SILICO FSV DANA 200027 |
| Q02 | 200063 | TRANS SILICO NPN 016 DANA 200063 |
| Q03 | 200063 | TRANS SILICO NPN 016 DANA 200063 |
| Q04 | 200022 | TRANS SILICO PNP 012 DANA 200022 |

PARTS LIST

ASSEMBLY 402983 PC Board Assy-Isolator, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION |
|---|---|---|
| Q05 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q06 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q07 | 200022 | TRANS SILICO PNP 012 DANA 200022 |
| Q08 | 200035 | TRANS SILICO NPN 014 DANA 200035 |
| Q09 | 200035 | TRANS SILICO NPN 014 DANA 200035 |
| Q10 | 201084 | TRANS GERMAN PNP 2N1304 1 TI 2N1304 |
| Q11 | 200044 | TRANS SILICO NPN DUAL FSV DANA 200044 |
| Q12 | 200044 | TRANS SILICO NPN DUAL FSV DANA 200044 |
| Q13 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q14 | 200043 | TRANS SILICO NPN 2N3565 FAIRCHILD 2N3565 |
| Q15 | 200011 | TRANS SILICO PNP 009 DANA 200011 |
| Q16 | 200035 | TRANS SILICO NPN 014 DANA 200035 |
| R01 | 000122 | RES CARBON 1.2 K 5% 1/4 W1 OHMITE RC07GF122J |
| R02 | 000122 | RES CARBON 1.2 K 5% 1/4 W1 OHMITE RC07GF122J |
| R03 | 000622 | RES CARBON 6.2 K 5% 1/4 W1 OHMITE RC07GF622J |
| R04 | 001737 | RES FSV 5% 1/4 W DANA 001737 |
| R05 | 011178 | RES METAL 4.99 K 1% 1/4 W ELECTRA RN20X4994F |
| R06 | 040055 | RES VARI 500 K 10% 1/5 W BOURNS 3068-P-1-50 |
| R07 | 000335 | RES CARBON 3.3 M 5% 1/4 W1 OHMITE RC07GF335J |
| R08 | 040057 | RES VARI 250 K 20% 1/4 W CTS 45 |
| R09 | 001737 | RES FSV 5% 1/4 W DANA 001737 |
| R10 | 011178 | RES METAL 4.99 K 1% 1/4 W ELECTRA RN20X4994F |
| R11 | 000242 | RES CARBON 2.4 K 5% 1/4 W1 OHMITE RC07GF242J |
| R12 | 000912 | RES CARBON 9.1 K 5% 1/4 W1 OHMITE RC07GF912J |
| R13 | 000393 | RES CARBON 39 K 5% 1/4 W OHMITE RC07GF393J |
| R14 | 000102 | RES CARBON 1 K 5% 1/4 W1 OHMITE RC07GF102J |
| R15 | 000472 | RES CARBON 4.7 K 5% 1/4 W1 OHMITE RC07GF472J |
| R16 | 000433 | RES CARBON 43 K 5% 1/4 W OHMITE RC07GF433J |
| R17 | 000912 | RES CARBON 9.1 K 5% 1/4 W1 OHMITE RC07GF912J |
| R18 | 000912 | RES CARBON 9.1 K 5% 1/4 W1 OHMITE RC07GF912J |
| R19 | 000303 | RES CARBON 30 K 5% 1/4 W1 OHMITE RC07GF303J |
| R20 | 000332 | RES CARBON 3.3 K 5% 1/4 W1 OHMITE RC07GF332J |
| R21 | 000153 | RES CARBON 15 K 5% 1/4 W1 OHMITE RC07GF153J |
| R22 | 000511 | RES CARBON 510 OHM 5% 1/4 W1 OHMITE RC07GF511J |
| R23 | 000101 | RES CARBON 100 OHM 5% 1/4 W1 OHMITE RC07GF101J |
| R24 | 000240 | RES CARBON 24 OHM 5% 1/4 W1 OHMITE RC07GF240J |
| R25 | 000750 | RES CARBON 75 OHM 5% 1/4 W1 OHMITE RC07GF750J |
| R26 | 000240 | RES CARBON 24 OHM 5% 1/4 W1 OHMITE RC07GF240J |

PARTS LIST

ASSEMBLY 402983 PC Board Assy-Isolator, 031 A

| REF. DESIG. | PART NO. | DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| R27 | 000101 | RES | CARBON | 100 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF101J |
| R28 | 000132 | RES | CARBON | 1.3 | K | 5% | 1/4 W | OHMITE | RC07GF132J |
| R29 | 010249 | RES | WW | 25 | M | 2% | 1/8 W | DALE | DC-2 |
| R30 | 040053 | RES | VARI | 5 | K | 10% | 1.5 W | CTS | 110 |
| R31 | 001737 | RES | FSV | | | 5% | 1/4 W | DANA | 001737 |
| R32 | 000136 | RES | CARBON | 13 | M | 5% | 1/4 W | OHMITE | RC07GF136J |
| R33 | 000752 | RES | CARBON | 7.5 | K | 5% | 1/4 W1 | OHMITE | RC07GF752J |
| R34 | 000335 | RES | CARBON | 3.3 | M | 5% | 1/4 W1 | OHMITE | RC07GF335J |
| R35 | 000565 | RES | CARBON | 5.6 | M | 5% | 1/4 W1 | OHMITE | RC07GF565J |
| R36 | 000513 | RES | CARBON | 51 | K | 5% | 1/4 W1 | OHMITE | RC07GF513J |
| R37 | 000122 | RES | CARBON | 1.2 | K | 5% | 1/4 W1 | OHMITE | RC07GF122J |
| R38 | 000120 | RES | CARBON | 12 | OHM | 5% | 1/4 W | OHMITE | RC07GF120J |
| R39 | 000101 | RES | CARBON | 100 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF101J |
| R40 | 000101 | RES | CARBON | 100 | OHM | 5% | 1/4 W1 | OHMITE | RC07GF101J |
| R41 | 000153 | RES | CARBON | 15 | K | 5% | 1/4 W1 | OHMITE | RC07GF153J |
| R42 | 000623 | RES | CARBON | 62 | K | 5% | 1/4 W1 | OHMITE | RC07GF623J |
| R43 | 040050 | RES | VARI | 5 | K | 10% | 1/2 W | BOURNS | 3067-P-1-K0 |
| R44 | 010308 | RES | METAL | 49.9 | OHM | 1% | 1/4 W | ELECTRA | RN60DT-0 |

# Warranty

It is the practice of Dana Laboratories, Incorporated, to manufacture only products of a quality that will merit customer satisfaction. The company recognizes that customer satisfaction is achieved, not only by delivering products meeting advertised performance specifications and having a high level of reliability, but also by honestly and efficiently fulfilling their warranty obligations as set forth below.

Dana Laboratories, Inc., agrees to correct, either by repair or replacement, any defect of material or workmanship in Dana-manufactured units or components which develop within one year after delivery of the equipment to the original purchaser — provided that the equipment has been subjected only to normal and proper use.

In the event of failure of any component delivered with Dana equipment, but not manufactured by Dana Laboratories, assistance will be given the customer in obtaining, from the original manufacturer, reasonable adjustment under that manufacturer's warranty.

Any item claimed to be defective during the warranty period must be returned to Dana Laboratories, Inc., with transportation charges prepaid. The item will be repaired and returned to the purchaser with return transportation prepaid by Dana unless, of course, the item is found not to be defective or found to be damaged by misuse — in which case it will be returned to the purchaser with repair and transportation billed collect.

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